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ASB 71ST ANNUAL MEETING APRIL 7-10, 2010

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Western Carolina University Cullowhee, North Carolina, and University of North Carolina Asheville, North Carolina

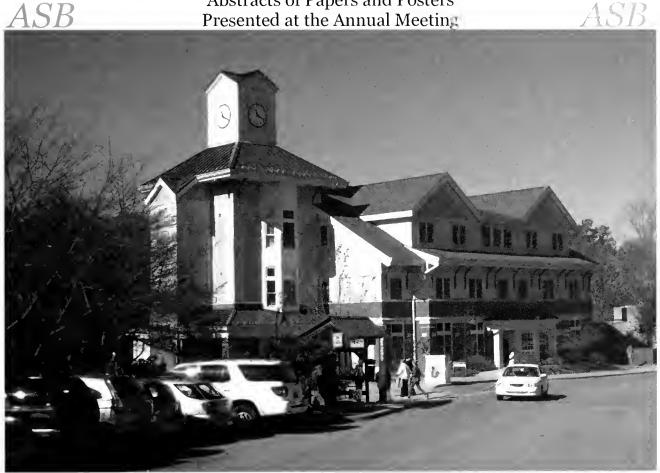
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Abstracts of Papers and Posters

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Governor's Hall, one of the more modern dormitory facilities on the campus of the University of North Carolina, Asheville, North Carolina.

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Purpose

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

- April 13-16: Hosted by the University of Alabama, Huntsville, Alabama. Meeting site is the Von Braun Convention 2011
- Center adjacent to the Embassy Suites Hotel, Huntsville, Alabama.

 April 3-7: Hosted by the University of Georgia, Athens, Georgia. Meeting site is the Georgia Center on campus. 2012 April 10-13: Hosted by Marshall University, Huntington, WV. Meeting site is the Charleston Convention Center, 2013 Charleston, WV.

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS EXECUTIVE COMMITTEE MEETING SATURDAY, 19 SEPTEMBER 2009 HUNTSVILLE, ALABAMA

ATTENDANCE: 15 individuals attended the meeting

NAME CAPACITY

Patricia Cox President

Floyd Scott Vice President

Nicole Turrill Welch Secretary
Tim Atkinson Treasurer

Terry Richardson Membership Officer
Ron Dimock EC Member-at-Large
Randy Small EC Member-at-Large
Joey Shaw EC Member-at-Large

George Cline EC Member-at-Large, 2009 LAC

John Herr Archivist
James Caponetti Print Editor

Scott Jewell Meetings Coordinator
Ginger Bayless Meetings Planner
Don Roush Beta Beta Beta

Bruce Stallsmith 2011 LAC

1. Call to order

President Patricia Cox called the meeting to order at 8:05 a.m. and welcomed everyone to Huntsville, Alabama. She shared a brief presentation summarizing Roberts Rules of Order, and discussed efforts to green the meeting.

2. Approval of the Executive Committee Meeting Minutes

Motion 1. Randy Small moved to accept the edited 1 April 2009 and 4 April 2009 minutes of Executive Committee Meetings. Ron Dimock seconded the motion and the motion passed.

3. Officers and Executive Committee Reports

President – Patricia Cox

Pat successfully filled committee membership, thanks to members who volunteered at the Leadership Workshop at the 2009 Annual Meeting. She also wrote a letter in support of the Louisiana Coalition for Sciences' efforts in rewriting several sections of ACT 473 on the teaching of creationism that was

implemented on 13 January 2009. Additionally, Pat has worked with the Asheville LAC, wrote "The View from Here" and recruited members to the Association while attending the Botanical Society of America Meetings in Snowbird, Utah.

Vice President - Floyd Scott

Floyd secured Dr. David L. Wagner as the Plenary Speaker for the 2010 Annual Meeting in Asheville, North Carolina. Dr. Wagner is a well-known and widely published entomologist at the University of Connecticut. He has coauthored several books, dozens of scientific papers and four web-based documents on lepidopterans and odonates. His travel and lodging will be covered by the Association, and he will be given a \$750 stipend.

Secretary - Nicole Turrill Welch

Nicole worked closely with Past President, Tom Wentworth, and President, Patricia Cox, to ensure the completeness and correctness of the minutes from the 2009 Business Meeting of the Association, as well as meetings of this Executive Committee. She also reworked the officer and committee chair annual report forms to expedite entry of their information into the minutes.

Treasurer, Business Manager - Tim Atkinson

Tim distributed copies of the Association of Southeastern Biologists brochure being used to recruit new members. He shared a lengthy list of his activities to date, highlighted by updates to the online payment and purchasing system, exhibit booths at two national meetings of scientific societies, and examining an offer from Integra to print *Southeastern Biology*. The proposed budget for FY 1January-31 December 2010 outlined how the projected expenses will be covered.

Motion 2. It was moved and seconded to accept the proposed budget. The motion carried.

Archivist – John Herr

John transported many documents to the archives since April 2009. He is reviewing all of the archives, held at the University of Georgia since 1965, to write a brief history of the Association of Southeastern Biologists for the 2012 Annual Meeting, to be held in Athens, Georgia.

Print Editor – Jim Caponetti

Jim reported that the October issue of *Southeastern Biology* will be mailed to members next week, and includes the list of 2009 award winners, the call for papers and posters for the 2010 Annual Meeting, and preliminary information for the 2010 Annual Meeting in Asheville, North Carolina. October 28 is the deadline for submitting materials for the January issue of *Southeastern Biology*.

Membership Officer - Terry Richardson

Most of Terry's work since April 2009 focused on the Membership Survey, summarized under New Business of these minutes.

Meetings Coordinator - Scott Jewell

Scott Jewell and Ginger Bayless wrapped up details of the 2009 Annual Meeting in Birmingham, Alabama, and finalized negotiations for the 2012 Meeting in Athens, Georgia. They completed a site visit to Charleston and Snowshoe, West Virginia for the 2013 Meeting, and have submitted their report on those sites to the Place of Meeting Committee Meeting. Scott and Tim Atkinson will be attending the National Association of Biology Teachers Meeting in Denver, Colorado in October 2009.

Book Editors

Pat Cox, President, recruited Melissa Pilgram, University of South Carolina Upstate, to be Editor. Jennifer Ellis, University of Georgia, and Chris Brown, Shorter College, will serve as Co-Editors. This somewhat complex arrangement results from a series of miscommunications, and the editors are awaiting arrival of accumulated books from Debbie Moore.

4. Committee Reports

Member Benefit Committee – Terry Richardson

Potential member benefits identified from the results of the Membership Survey are described under New Business of these minutes.

Local Arrangement Committee

ASB 2009 Birmingham, AL - George Cline

Seven hundred thirty-four people attended the 2009 Annual Meeting. The meeting profited approximately \$21,000 and the Silent Auction brought in roughly \$3400 to support student travel. Randy Small pointed out that most of the profit of this meeting was from exhibitors, and thanked Scott Jewell for all of his work on bringing in a multitude and variety of exhibitors to this meeting.

ASB 2010 Asheville, NC – Beverly Collins / Jonathan Horton (not in attendance)

The Thursday night social will be in an eclectic venue with both jazz and local bands. Ten field trips, mostly along the Parkway, have been arranged. Abstract submission will be electronic, and the committee is working on procuring laptops and LCD projectors. Donations for the Silent Auction are being accepted, and all proceeds from this auction support student travel for the Annual Meetings. Scott

Jewell and Ginger Bayless stopped in Asheville on their way to this meeting and were very pleased with how the 2010 Annual Meeting is shaping up.

ASB 2011 Huntsville, Alabama - Bruce Stallworth

Bruce shared some of the biological highlights of the area, in addition to information on the Space Center. Meeting facilities are good, and the fine details of the meeting remain under discussion. Faculty members from regional universities are being recruited to assist with field trips and other events. Ron Dimock raised concerns of feeding 800-1000 people, when the only restaurant in the conference hotel is expensive. Scott Jewell reported that box lunches will be arranged, and the convention center food and beverage service is reasonably priced. There also are many places within a 10-15 minute walk, and the area is considered extremely safe for pedestrian traffic. The conference hotel shuttle is free, and easily arranged. The room rate at the conference hotel includes breakfast and the manager's social each evening. Students will be able to sleep 4-6 to a suite, so the 2011 Annual Meeting should be considered affordable.

Place of Meeting Committee – John Herr

The contract on the 2012 Meeting in Athens, Georgia, has been signed. However, a Local Arrangements Committee has not been secured, and there is much local resistance to serving on this committee. The meeting will be held at the University of Georgia Center, the smaller of the two Athens convention venues, but the only one that would result in an affordable meeting. This meeting will be the 75th anniversary of the founding of the Association, and high attendance is expected.

The Place of Meeting Committee is comparing Charleston and Snowshoe, West Virginia, for the 2013 Meeting. There are many financial and logistical advantages to hosting the meeting in Charleston; however, the two volunteers who wish to serve as hosts are very much wedded to the meeting being held in Snowshoe. Discussions will continue.

Publication Committee - Ron Dimock and Randy Small

Katie Greenberg stepped down as Chair of the Committee. Ron Dimock and Randy Small stepped up to become co-chairs of the Committee, and they wish to examine alternatives to publishing *Southeastern Biology*, emphasizing electronic means of communication rather than print.

OLD BUSINESS

Honorary Lifetime Membership – John Herr

Dr. Edward O. Wilson received the medal designating him the first Honorary Lifetime Member and Fellow of the Association of Southeastern Biologists. John

also shared details of the special Book of Fellows of the Association, which Dr. Wilson will be the first to sign. He emphasized that the Honorary Lifetime Member and Fellow designations are separate, but only the fellows will sign the Book of Fellows. The Book of Fellows will be housed in the Archives and retrieved only when the designation is bestowed.

Formation of a Standing Program Committee

Nicole Turrill Welch will work with Patricia Cox to form this ad hoc committee. They will strive to have the Program Committee organize the program for the 2011 Annual Meeting in Huntsville, Alabama.

Formation of Standing Committee for Bioinformatics

This committee seeks a woman scientist, using molecular techniques to study a non-plant model system, to complete the Committee for Bioinformatics. This committee will work closely with the Association of Southeastern Biologists, due to the potential great success that exists with the diversity of fields of study of its members.

NEW BUSINESS

Enrichment Fund

Mike Dennis has procured another anonymous donor to match funds raised at the 2010 Annual Meeting. He asks that the Executive Committee members all commit donations to the Enrichment Fund, and seek additional donations to the Enrichment Fund at the 2010 Meeting in Asheville, North Carolina. Tim Atkinson will help Mike Dennis designate the Outstanding Biology Teacher from North Carolina for recognition at the 2010 Annual Meeting.

Member Survey

Terry Richardson summarized the 47-question survey and reported the key findings. The survey was completed by 356 of our approximate 1100 current members. Most members joined as undergraduate or graduate students, and nearly 60% have been a member for less than 10 years. Results revealed that word of mouth is our best recruiting tool. In general, the membership is aging, with 67% of respondents over age 35 - 49, and 40% over the age of 50. Respondents were 60% male, predominantly Caucasian, and the great majority were employed as professors and researchers. Indeed, the survey revealed that the majority of members teach at 2- and 4-year colleges and universities. Only 18.3% of respondents were students, suggesting fewer incoming students, although no data are available for historic comparison. Ninety-eight percent of respondents thought that membership is a good value, and most considered the annual meeting and its opportunities for professional networking valuable. A portion of the expenses of the annual meeting are paid out of pocket by 35% of

members. Ecology and Botany were the topics of most interest to our membership, and 85% belong to other biological or teaching organizations. Eighty-two percent of respondents do not subscribe to *Southeastern Naturalist*.

Discussion of the survey results was lively, and centered on the need to increase participation of faculty from research institutions training M.S. and Ph.D. students, the future lifeblood of our organization. The most under-represented disciplines in our membership and at our annual meeting are the lab-oriented and theoretical sciences, including bioinformatics. Benefits suggested by the respondents included enhanced grant opportunities for members, special discounts exclusive to members, and online materials. Discussion of using the Enrichment Fund to facilitate research grants for graduate students ensued, including discussion of forming an ad hoc committee to examine this in detail. More notable were the 70% of members who said that our Association should have its own peer-reviewed journal, as well as other venues to share research and teaching resources. The Executive Committee urges discussion with the editors and managing board of Southeastern Naturalists to explore a future alliance. Additionally, many members would like to see more non-commercial workshops at the annual meeting, and the Executive Committee asked the 2010 and 2011 Local Arrangements Committees to heed this request.

Proposals for 2010 Annual Meeting Workshops and Symposia

Jennifer Davis – General proposal submitted by Committee on Human Diversity – Advising undergraduates on how to get into graduate school, and how to select a graduate program. This session could include graduate students and faculty, and evolve into career planning and professional development. Patricia Cox forwarded this proposal to the Education Committee. Terry Richardson and others stated that the Education Committee should be charged with (1) advising undergraduate students on graduate school, (2) advising graduate students on CV development, teaching statements, etc., and (3) information for early-career faculty on tenure and promotion.

Human Diversity Committee – The Human Diversity Committee seeks funds to bring in a speaker on minorities in science to the 2010 ASB Meeting

Motion 3. Terry Richardson moved that ASB provide \$800 to the Human Diversity Committee to recruit a speaker on the topic of minorities in science. The motion was seconded and approved. This money would provide space and lunch for 50 people.

Motion 4. It was moved to accept Katie Greenberg and Beverly Collin's proposal for the symposium "Early successional habitats and the sustainability of age

class diversity of eastern upland hardwood forest: what, why, where, and how?" Seconded and passed.

Motion 5. It was moved to accept Gary Wein's proposal for the symposium "Conservation in western North Carolina." The motion carried.

Zack Murrell - Zack Murrell submitted a proposal for a SERNAC Workshop.

Motion 6. It was moved to accept Zach Murrell's proposed workshop. The motion carried.

Changes to the Leadership Guide for LAC and Place of Meeting Committee Patricia Cox stressed that the duties of the LAC and Place of Meeting Committee need to be well-outlined immediately.

Motion 6. Floyd Scott moved to increase pay to Eunice Turner from \$100 to \$200 for her assistance with *Southeastern Biology*. The motion passed.

7. Announcements

John Herr announced the availability of herbarium bumper stickers. Tim Atkinson stated that Association brochures are available for distribution. Tim Atkinson also asked for us to refer a person who is a herbarium expert in the Southeast, needed to serve as an expert witness.

8. Adjournment

Motion 7. A motion to adjourn was received at 1:50 p.m. President Pat Cox thanked everyone for coming and for their hard work during the year and meeting.

Respectfully submitted,

Nicole Turrill Welch, Secretary 11 March 2010

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS 71st ANNUAL BUSINESS MEETING FRIDAY, 9 APRIL 2010 ASHEVILLE, NORTH CARONLINA

1. Call to Order and Welcome

President Patricia Cox called the meeting to order at 11:05 a.m. Approximately 100 people attended the meeting.

- **2. Approval of the Minutes** On behalf of Secretary Nicole Turrill Welch, President Patricia Cox presented the minutes of the 2009 Business Meeting as published in the July 2009 issue of *Southeastern Biology*. A motion to accept the minutes as published was made, seconded and approved.
- 3. Election of Officers The President on behalf of Tom Wentworth, Chair of the Nominating Committee, presented the 2010 candidates. President-Elect Don Roush and Wayne Van Devender; Vice President Jennifer Davis and Ray Williams; Secretary Conley McMullen (Terry Richardson withdrew his nomination for Secretary); and Member-at-Large James Costa, Christi McGrath, Ashley Morris, and Alan Weakley. There was a call for further nominations from the floor and, being none, it was moved that the nominations close. Tellers distributed the ballots and the members voted. Tom Wentworth asked the tellers to retire, count the ballots, and announce the results at the Banquet.
- 4. Recognition of Members Who Passed Away in 2009-2010 President Patricia Cox shared the news that Jack S. Brown, Joseph V. Nabholz, Jerry Richie, William H. Ellis, and Mary Esther Gaulden Jagger passed away this past year, and asked for a moment of silence to pay our respects to them. Patricia then paid special respect to the members of the University of Alabama—Birmingham, Department of Biology, Gopi Podila, Adriel Johnson, and Maria Ragland Davis, who lost their lives in a tragic turn of events on February 12, 2010.
- **5. Treasurer Report** Tim Atkinson, Treasurer, shared that at the end of FY 2009 the Association shows a net increase of \$14,516 as of December 31, 2009, including monies donated to the Enrichment Fund. Income for the Association was the highest ever in the history of the Association. Costs were well down, especially for *Southeastern Biology*. Tim thanked Print Editor, Jim Caponetti, for more evenly distributing information across the issues and, thus, lowering cost of publication. It was moved and seconded to receive the Treasurer's Report and the motion carried.
- **6. Enrichment Fund Report** Mike Dennis, Chair of the Enrichment Fund Committee, thanked members for meeting the challenge of the 2009 anonymous donor and thereby adding \$10,000 to the Enrichment Fund. Mike reiterated the challenge of the 2010 anonymous donor, which required all members of the Executive Committee to make a donation. He reported that all members of the Executive Committee had contributed, and that contributions now could be

accepted from the entire membership. Mike encouraged everyone to donate, as the Enrichment Fund stabilizes the Association's budget when accounts received become low. This fund also supplements the Graduate Student Support Awards and the recognition of the Outstanding Biology Teacher of the state hosting the Annual Meeting.

- 7. Members Requesting Emeritus Status President Patricia Cox announced, as conveyed to her by the Membership Officer, Terry Richardson, that John M. Schmidt, Susan M. Schmidt, and Lafayette Frederick seek Emeritus Status. A motion to grant these members Emeritus status was made and seconded. The motion carried.
- **8. Resolutions** Tom Wentworth, Chair of the Resolutions Committee, read the Resolution of Appreciation to Western Carolina University, University of North Carolina-Asheville, the Local Arrangements Committee, and the City of Asheville, North Carolina. It was moved and seconded to accept the resolution. The motion passed.
- **9. Announcements** Our President announced that the Southern Appalachian Botanical Society would host a reception prior to the Banquet for student members involved in botanical research.
- **11. Adjournment** Patricia Cox thanked everyone for attending and the meeting was adjourned at 11:25 a.m.
- **12. Election Results** Announced at the Friday night awards banquet.

President-Elect – Don Roush Vice President – Jennifer Davis Secretary – Conley McMullen Members-at-Large (2010-2013) – James Costa Ashley Morris

Respectfully submitted,

Nicole Turrill Welch, Secretary 22 April 2010

CALL FOR NON-COMMERCIAL WORKSHOP AND SYMPOSIUM PROPOSALS FOR THE 2011 ANNUAL MEETING OF THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

Deadline for Receipt of Proposals: August 27, 2010

Proposals for non-commercial Workshops (hereafter referred to as Workshops) and Symposia to be offered at annual meetings of the Association of Southeastern Biologists must be prepared and submitted for review as described in this Call for Proposals; the same criteria for proposal preparation, submission, and review apply to proposals originating from internal leadership bodies within ASB (such as standing committees) and from individuals or groups outside of Commercial workshops are arranged through the Meetings Coordinator, and they are subject to separate guidelines that can be obtained from the Meetings Coordinator. Written proposals for Workshops and Symposia must be submitted to the Chair of the relevant Local Arrangements Committee (LAC), the Program Chair of the LAC, and the ASB President no later than two weeks prior to the fall interim meeting of the ASB Executive Committee. Proposals for Workshops must clearly describe their structure (including maximum number of participants) and concept, as well as prerequisites, space and other facilities requirements, and request for funding from ASB (if any). Proposals for Symposia must clearly address all five of the criteria listed below and be accompanied by letters of endorsement (if any). All proposals will be peer-reviewed and ranked by the Program Chair of the LAC and the ASB Executive Committee. Decisions to accept or reject proposals will be made at the fall interim meeting of the ASB Executive Committee, and proposers will be contacted shortly thereafter.

Workshops

Structure & Concept: Workshops are flexible in their structure. They can be a half-day, full day, or two days in length. Lunchtime Workshops are also offered. Workshop structure is determined by the organizers. Workshops typically have maximum enrollments, and they may specify prerequisites for participation (Workshops should be open to all meeting attendees, first-come first-served, who meet these prerequisites). Workshops often have a registration fee to cover A/V equipment and preparation. Workshops are intended to convey specific knowledge or skills; they are not intended for the presentation of research papers. Workshops are frequently more interactive and informal than sessions within the formal scientific program, and they are not scheduled concurrently with Symposia, contributed oral sessions, or poster sessions. Workshops may involve one or several teachers/presenters, and they may include computer-based or other 'hands-on' training. Weekend Workshops may be linked with a scientific field trip. A Workshop proposal should make clear what participants might expect to gain, and how the Workshop furthers the overall goals of the Association of Southeastern Biologists (these two aspects are the major criteria for Workshop acceptance). Limits of space and time may make it impossible to accommodate all worthy submissions.

Call for Proposals 227

Symposia

Structure & Concept: Symposia are a half-day or a full day in length. The number of speakers and the length of each talk are determined by the session organizers; talks should be between 15 and 30 minutes long, and presentation times can vary between speakers. Each session should include at least one 30 minute break that will be synchronized with the coffee break of all concurrent sessions. Generally, Symposia should be focused, integrated presentations assessing current understanding regarding a particular research problem, concept, application, or educational theme. Symposia should have broad appeal to members of ASB or involve integration across sub-disciplines.

Symposium proposals will be assessed under the following criteria. Weighting of particular criteria may vary depending on the nature of proposals, but proposals should explicitly address these criteria, as appropriate. There is typically room for only three Symposia at the annual ASB meeting.

Criteria for Evaluation of Symposium Proposals

- Scientific strength: Symposia are the scientific centerpieces of the meeting, and should:
 - offer significant contributions to biological understanding,
 - present innovative or interdisciplinary approaches, including novel collaborations or syntheses across subdisciplines, and
 - have broad enough appeal to generate large audiences (>100 people) at the meeting.
- 2. **Structure and organization:** Symposia should be more explicitly integrated than other sessions, and should be structured to:
 - provide overall synthesis or overview; they should not be simply a set of related case studies,
 - avoid taking a narrow perspective on the Symposium topic; organizers should carefully avoid appearance of biases toward their own perspectives, and
 - build a well-integrated whole; each talk should have clear relevance to overall synthesis.
- Speakers: Invited speakers should bring new contributions to the session, not simply reviews of previous work. Inclusion of experienced or particularly engaging speakers can strengthen a proposal, but new voices are also important. Proposals with a larger proportion of confirmed speakers will be favored.
- 4. Funding: Workshop and Symposium proposers must certify that they have sufficient funding available to cover all costs of the program <u>as proposed</u>, including expenses (travel, meals, lodging, honoraria) for all invited speakers. If additional funds are needed beyond those available to the proposers, such funds must be identified and may be requested from the ASB Executive Committee (EC), which has some funding available for Symposium proposals, usually reserved for proposals that come from ASB standing committees. If requesting funds from the EC, the Symposium proposers must specify an amount and justify that amount. If the EC provides funds

- requested by the Symposium proposers, it is assumed that the Symposium is fully funded as described. If partial funding is offered by the EC, the Symposium proposers must subsequently secure the additional funds required to cover all costs.
- 5. **Integration:** Proposals may receive higher priority if they are clearly linked to the meeting's overall theme, or if they offer particular value or insight in the context of other sessions proposed for the meeting or of Symposia at recent ASB meetings.

Endorsements

Workshops and Symposia are often endorsed by various groups, agencies, and organizations including international societies, private non-governmental organizations, governmental agencies, or internal leadership bodies within ASB, such as standing committees. These endorsements will be considered in review of proposals, particularly if they emphasize why the group finds merit (in terms of evaluation criteria above) in the proposal. Each of these groups, organizations, or agencies is allowed to endorse only one Symposium proposal. If a group submits a proposal, that group is considered to be endorsing its own proposal, and it cannot endorse another. Symposium proposers, in requesting endorsements, should make this policy clear. There is NO guarantee that a proposal endorsed by any group or organization will be accepted. Individuals preparing letters of endorsement should send them directly to those preparing the proposal for inclusion as part of the proposal package.

If Your Proposal Is Accepted

After proposals are accepted and the scheduling for the meeting is underway, cancellations and schedule changes are very disruptive to meeting planning. Hence, organizers of Workshops should obtain firm commitments from their teachers/presenters and organizers of Symposia should obtain firm commitments from as many of their invited speakers as possible before submitting their proposals. Requests for additional funding will not be considered by the ASB Executive Committee.

If a proposal is accepted, the organizers must submit a final summary description of the Workshop or Symposium to the Program Chair of the LAC at the same time abstracts are due. This summary will appear on the meeting website and should be written so as to stimulate interest and promote attendance. This description must include a complete and current listing of organizers' names and their affiliations, addresses, telephone and fax numbers, and email addresses; a 400-word narrative description of the session; a 50-word sentence description of the session; and a final, confirmed speaker list.

It is the responsibility of Symposium organizer(s) to see that each speaker submits an individual abstract of his/her talk using ASB's abstract submission criteria by the abstract submission deadline. It is not permissible to submit abstracts by any other means. Contact the Program Chair of the LAC if your situation precludes use of the abstract submission website.

It is suggested and encouraged that a written summary of the Workshop or Symposium be submitted to Southeastern Biology for publication.

Call for Proposals 229

Non-Commercial Workshop/Symposium Proposal Submission Form

Title:

Submitters' Contact Information (address, phone, and e-mail address):

Session Description: In 400 words or less and in sentence form, describe the theme and purpose of this session.

Session Justification: In 250 words or less and in sentence form, provide the justification for this session.

One-sentence Summary: Summarize your proposal in 50 words or less.

Speakers and Titles: List all teachers/presenters (Workshops) or speakers and their titles (Symposia). Next to each participant, indicate if they are confirmed or only contacted and have not yet decided (unconfirmed). Do not list individuals who have not yet been contacted.

Funding: Explain how the Workshop or Symposium <u>as proposed</u> is to be funded. Symposium proposers may request needed funds from the ASB Executive Committee.

This form must be submitted to the following individuals no later than two weeks prior to the fall interim meeting of the ASB Executive Committee (deadline is August 27, 2010).

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Southern Appalachian Botanical Society 75th Anniversary Celebration and Symposium

Held in conjunction with the 72nd annual meeting of the Association of Southeastern Biologists

Meeting Site:

The Von Braun Center, Huntsville, Alabama April 13-16, 2011

The Program will include the following events:

A symposium with featured speakers: "A Thread of the Past, the Present, and Future Botanical Research"; A Breakfast meeting and photo-display of SABS history; A current group photograph and a display of past group photographs; Special recognitions of important contributors; An updated presentation of "And Who Will Weigh the Mountains;" 75th anniversary commemorative memorabilia; Field trips; A special commemorative issue of *Castanea*.



ASB

Paper and Poster Abstracts

From the 71st Annual Meeting

Co-Hosted by

Western Carolina University

and

University of North Carolina

Asheville, North Carolina

April 7-10, 2010

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ASB Symposium Abstracts

S1: Early Successional Habitat and the Sustainability of Age Class Diversity of Eastern Upland Hardwood Forest: What, Why, Where, and How? Organized by Cathryn H. Greenberg and Beverly Collins (USDA Forest Service, Southern Research Station, Bent Creek Experimental Forest, and Western Carolina University)

S1.1 PETER WHITE¹ AND BEVERLY COLLINS². University of North Carolina, Chapel Hill¹, Western Carolina University². Natural disturbances and the sustainability of early successional habitat and age class diversity in the eastern upland hardwood forest region.

Natural disturbances can create early successional habitat at scales from gaps to the landscape; repeated disturbances can maintain these habitats. Regenerating forests and smaller forest patch sizes since the early 1900's, combined with expected increases in severe windstorms, drought, pathogens, and other climate-related disturbances, foretell increasing frequency of larger, stand and landscape-scale, disturbance patches in eastern upland hardwood forests. These sites would favor establishment of early successional species and thus generate habitat and age class diversity over the landscape. Patterns of natural disturbances, including interactions among disturbance types, vary among forest types and over environmental gradients within the eastern upland hardwood region. We will review these patterns and discuss species responses that contribute to diversity and persistence of early successional vegetation.

S1.2 STEPHEN R. SHIFLEY AND FRANK R. THOMPSON. USDA Forest Service, Northern Research Station. <u>Patterns in early-successional forest habitat in the eastern US: Regional to landscape effects of management and disturbance.</u>

At the national and regional scale (hundreds of millions of acres) Forest Inventory and Analysis (FIA) data provide simple indicators of the amount and distribution of forest habitats in the form of forest age distributions and their change over time. Five decades of FIA data show the gradual shift of Eastern forests to older age classes with concomitant losses of early successional habitat. These changes are the inevitable outcome of extensive logging and land clearing in the late 19th and early 20th centuries followed by forest regeneration and decades with comparatively little disturbance by timber harvesting and fire. Large scale patterns of forest age distributions are among the simplest largescale indicators of forest habitats, yet they have rarely been used for large-scale evaluation and planning for conservation of forest wildlife. We use forest age distributions to describe the current patterns of forest structural diversity in Eastern forests and the associated temporal trends. The trend toward ageing forests with declining area of early successional habitat has been slow but persistent. It has been decades in the making and will not be easily altered. At the landscape scale (thousands to millions of acres) we use simulation modeling to demonstrate how forest management practices and disturbances by wind and fire interact to affect the amount and spatial distribution of early successional forest habitat. We demonstrate the associated impacts to selected early succession wildlife species by linking these outputs with wildlife habitat models.

S1.3 NICK HADDAD¹ AND DOUG LEVEY². North Carolina State University¹, University of Florida². Multi-species connectivity for upland forests.

A commonly proposed strategy to overcome the negative effects of habitat loss and fragmentation is to reconnect landscapes, typically with landscape corridors. Corridors should increase movement and gene flow, increase population persistence, and increase

biodiversity within fragmented landscapes. For 15 years, we have worked in a large-scale fragmentation experiment to test the effects of corridors on movement of many species of plants and animals. Using many different studies from within this experiment, we evaluate how life histories of plants and animals may be used to predict corridor effectiveness. We then review literature to test whether the life history framework we have developed may be applied more broadly to eastern US hardwood forests. We discuss the effectiveness of connectivity as a conservation strategy in the context of current forest cover and restoration in the eastern US, and in particular as an adaptation strategy to a changing climate.

S1.4 MARTIN SPETICH¹, STACY CLARK¹, AND CRAIG HARPER². USDA Forest Service, Southern Research Station¹, University of Tennessee². The historic role of fire in the eastern upland hardwood forest region.

Fire has played an important role in shaping upland hardwood forests of the eastern United States. Prior to European settlement periodic fires were common in much of this area and fire-resilient species proliferated. As Europeans moved west they commonly adapted Native American techniques of applying fire to the landscape. As the demand for wood products increased at the start of the industrial revolution, large cutover areas were burned, sometimes leading to catastrophic fires, particularly during periods of drought. As a result, political pressure and ignorance of the ecological role of fire ultimately led to policy that severely restricted the use of fire by the early 1900s. A period of fire suppression through the 20th century reduced the creation and maintenance of early successional vegetation communities, and reduced the abundance and coverage of fireresilient species that once thrived in the eastern upland hardwood forest region. Without fire, species that were not resistant to fire were able to successfully outcompete fire resistant species. The gradual decline of successful oak regeneration led to few or no oaks to fill the void when the overstory dies or is harvested. One century of fire suppression led to today's reduced coverage and maintenance of early succession and to severe decline of fire-resilient species. Integrating the responsible use of prescribed fire into the eastern upland forest region now could help mitigate past actions.

S1.5 DAVID L. LOFTIS, W. HENRY MCNAB, CALLIE J. SCHWEITZER, AND TARA L. KEYSER. USDA Forest Service, Southern Research Station. Changes in species composition and structure of upland hardwood communities after different silvicultural disturbances across environmental gradients.

The creation of young forest habitat can be accomplished with a broad array of silvicultural techniques. All have in common the eventual removal of all or most of the canopy trees in one or several cuttings in either large or small patch sizes. The composition, and, to some extent, early structural development, of the vegetation that results from these silvicultural techniques can be quite variable. In general, the composition resulting from the application of these silvicultural techniques is a function of the regeneration sources present at the time of application of the techniques and those that arrive during or after the cutting. The cumulative effects of disturbances and other events prior to the application of these silvicultural techniques (or significant natural disturbance creating similar conditions) are important in determining the regeneration sources present at the time of disturbance and, therefore, the composition following disturbance. The suite of species that is available for regeneration of a site, large or small, varies across multiple environmental gradients that include moisture, elevation (temperature) and soil chemical factors. Species often occur across a range of environmental gradients, but their performance relative to other species may change significantly as environmental conditions change.

S1.6 DAVID A. BUEHLER¹ AND KATHLEEN E. FRANZREB². University of Tennessee¹, USDA Forest Service, Southern Research Station². <u>Birds and early</u> successional habitat in the southeastern upland hardwood forest region.

Early successional habitats are an important integral part of the forest landscape. The status and trends of bird species that are neotropical migrants, short-distance migrants, or permanent residents who use such habitats has emerged as a conservation concern within the southeastern United States. Disturbances in eastern forests have resulted from various causes including land clearing for farming and development, fire, storms, grazing by native ungulates and livestock, and commercial timber harvesting. As the extent of the anthropogenic factors has declined, the amount of habitat suitable for early successional species also has decreased, now resulting in significant declines for many species. We examined the changes in the amount and distribution by age class of upland hardwood forests throughout the southeast using US Forest Service Forest Inventory and Analysis data. We examined US Geological Survey Breeding Bird Survey data for the Southeast focusing on 10 avian target species that use younger age classes of upland hardwood forests and analyzed US Forest Service Region 8 point count data for these same 10 species for National Forests in the southern Appalachians (Virginia, Tennessee, Georgia, and North Carolina). We estimated annual breeding bird densities for these species, documented temporal trends in density, and compared densities to changes in habitat availability derived from FIA data for early successional hardwood forest. Lastly, we offer some recommendations for management strategies to aid in the conservation of bird species that use early successional upland hardwood forest habitat in the Southeast.

S1.7 C. E. MOORMAN¹, K. R. RUSSELL², AND C. H. GREENBERG³. University of North Carolina¹, University of Wisconsin², USDA Forest Service, Southern Research Station³. Herpetofaunal response to forest management in eastern upland hardwood forests.

Herpetofaunal responses to forest management vary among regions and taxa, and likely are influenced by species-specific adaptations to historical disturbance regimes. In eastern upland hardwood forests, heavy canopy removal for forest regeneration treatments can adversely amphibians, especially salamanders. Canopy removal results in higher light levels, warmer, drier microclimates, and reduced leaf litter cover, which could cause salamanders to desiccate. In the southern Appalachians, salamanders may virtually disappear following clearcutting, with populations taking at least 20 years to fully recover. Conversely, disturbances that retain heavy canopy cover such as 2-age harvests or low intensity burns may have negligible impacts. Larval salamanders may be less abundant in streams with narrow forest buffers (<10m) adjacent to clearcut stands, likely because of increased sediment in streams, reduced canopy cover, and reduced food resulting from loss of leaf litter. Prescribed fire typically has a neutral or positive effect on anuran abundance, but fires that cause overstory mortality may cause salamander population declines. The effects of canopy reduction from timber harvest and intense prescribed fire on salamanders may be delayed for 2-3 years, especially when prescribed burning is conducted repeatedly. Hotter, drier microclimates in open, recently disturbed sites may benefit some reptile species, especially fence lizards. Maintenance of seral stage diversity across eastern upland hardwood forest landscapes should provide habitat for early successional wildlife and mature forest species, such as salamanders.

S1.8 SUSAN C. LOEB AND JOY M. O'KEEFE. USDA Forest Service, Southern Research Station. <u>Bats and gaps: the role of early successional patches in the roosting and foraging ecology of bats.</u>

Thirteen bat species commonly use eastern upland hardwood forests for foraging, commuting or roosting. There are few studies on the significance of early successional

habitats to bats of eastern upland hardwood forests, though these habitats are likely important foraging sites for most species due to their lack of clutter. We review previous studies of early successional habitat use by bats in a variety of ecosystems, and provide new examples of bat use of early successional habitats in southern Appalachian hardwood ecosystems. We relate results of these studies to morphology and echolocation call structure; patch and landscape characteristics; management history; insect availability; and predation risk. Because early successional habitats typically lack suitable roosts, their importance to bat roosting ecology is seldom considered. However, because early successional habitats may be important foraging sites for many species, their distribution on the landscape may play a significant role in roost site selection. Thus, we also examine the importance of early successional habitat for roosting and present evidence that bats select roost sites that are closer to early successional habitats than expected. We suggest that when considering the role of early successional habitat in the ecology of eastern hardwood forest bats, it is critical that researchers look beyond use versus non-use. Future research should also consider the effects of patch size and connectivity, successional stage, and management history. Because eastern bats are highly mobile and forage on prey whose abundance varies spatially, we suggest that future studies take a broad view and consider early successional habitats in the context of the larger landscape matrix.

S1.9 GORDON S. WARBURTON¹, CRAIG A. HARPER² AND KENDRICK WEEKS³. North Carolina Wildlife Resources Commission^{1,3}, University of Tennessee, Knoxville². Conservation and management of early successional and other disturbance dependant habitats for wildlife in the Eastern United States; a manager's perspective.

Early successional vegetation communities are as worthy of consideration on the landscape as mature and old-growth forest communities; however, early successional communities are declining precipitously. According to the Southern Appalachian Assessment, only 1-4% of the Southern Blue Ridge represents usable habitat for disturbance-dependent wildlife. Given the importance of early successional stages, there is a serious dilemma in providing necessary habitat for the associated wildlife across the landscape. We surveyed state agencies to determine listings of priority early successional species and available habitat in wildlife action plans. With information on what species and the stage/type of habitat needed, we then discuss approaches to estimating ESH across the landscape. Another problem is determining how much ESH is needed. We discuss and evaluate various approaches to resolving this issue, including managing for presettlement conditions, mimicking natural disturbance regimes, estimating historical frequencies of specific disturbance types and managing to maintain viable populations of early successional species in a variety of settings. These new approaches have challenges to implementation that involve integrating large datasets and large numbers of species. We also discuss direct management methods for creating the diverse range of disturbed habitats in managed and unmanaged areas.

S1.10 J. DREW LANHAM. Clemson University. <u>Fields of Shrub-Scrub Dreams:</u> Opportunities for Wildlife Conservation in Novel Places.

Species requiring early-successional habitats occupy ephemeral areas that depend upon periodic disturbance for their creation and persistence. In the eastern United States, acute anthropogenic disturbances such as forestry practices have accounted for much of the early-succession. Over the past few decades, however, aforestation trends, the decline of small scale agriculture and urban/suburban development in many regions have resulted in fewer areas of regenerating forest and/or grassland habitat. As a result a number of early-successional species (e.g. northern bobwhite quail, golden-winged warbler, Karner Blue Butterfly) have also declined. A number of alternatives for creating early-successional

exist in places like reclaimed landfills, strip mines, abandoned airfields and utility rights-of-way. Evidence shows that a number of these habitats, once reclaimed and restored to grassland or allowed to regenerate to forests can support declining species. I suggest that opportunities exist for managing novel places for the ephemeral habitats required by early-successional species. This paper will address the examples where such successes have occurred and potential for such opportunities in the future.

S1.11 KATHERINE ELLIOTT¹, CRAIG HARPER², AND BEVERLY COLLINS³. ¹USDA Forest Service, Southern Research Station, University of Tennessee², Western Carolina University³. Herbaceous layer response to type and severity of disturbance over time.

Disturbance in eastern hardwood forests can be frequent and range in type (harvesting, wildland fire, hurricane, ice storm, insect and disease, and drought) and severity (from low, where overstory trees incur no mortality, to high, where a new forest stand is initiated). Moderate to severe disturbances can change the relative composition of plant species and influence species diversity of all vertical vegetation layers, including the herbaceous layer. Greatest species diversity often occurs in the first few years after disturbance when low resource competition and high resource availability facilitate occupancy by species that require additional sunlight. For example, in the southern Appalachians, regeneration harvest methods with only partial canopy removal (e.g., shelterwood, single-tree, or group selection) provide a patchwork of environmental conditions that accommodates early (species that favor high light) and late (species that favor shade) successional species coexistence, which increases species diversity. In contrast, clearcut harvesting removes the entire canopy, provides a relatively homogenous habitat and favors early successional species; this environment may or may not have higher diversity than an uncut stand of similar size and type. Wildland fire (wildfire and prescribed) also influences composition and diversity of the herbaceous layer, especially high-severity fire or recurring fire on a relatively short return interval. Single, low-intensity fires do little to affect herbaceous layer composition, whereas recurring or high-severity fires cause tree seedling mortality and can increase cover of grasses and legumes. We will review herbaceous species responses under several disturbance types and severities in eastern upland hardwood forests.

S1.12 CATHRYN H. GREENBERG¹, DOUGLAS J. LEVEY², J. DREW LANHAM³, MARIA WHITEHEAD⁴, AND CRAIG HARPER⁵. USDA Forest Service, Southern Research Station¹, University of Florida², Clemson University³, The Nature Conservancy⁴, University of Tennessee⁵. Forest food resources for wildlife and early successional habitat in the eastern upland hardwood forest region.

Young upland hardwood forest provides important wildlife habitat that includes structural features and food resources including an abundance of young lush green foliage, native fleshy fruit, and arthropods. Native fleshy fruit production is much greater in forest openings caused by natural disturbance. In the southern Appalachians, fleshy fruit production is 5-20 times greater in young, recently harvested forest compared to mature forest, beginning 2 or 3 years after harvest. Disturbance-associated species such as pokeweed and blackberry are major fruit producers in young regenerated stands, but many other woody and herbaceous species that are not typically associated with disturbance such as huckleberry, native herbaceous plants (e.g., mandarin and Solomon's seal), and stump sprouts of trees also produce abundant fruit in young, recently harvested forest compared to mature forest. Recent clearcuts may provide over 10 times more dry biomass of forage and browse (<1.4 m high) than mature forest. Litter dwelling arthropods are generally more abundant in mature forest where shade and thicker leaf litter provide a cooler, moister microclimate relative to young stands. In contrast, flying and foliar arthropod abundance and biomass is higher in young stands, likely because of a higher

density and palatability of young plant foliage. Herbaceous plants attract pollinating insects, and may positively affect their abundance in recent clearcuts, prescribed burns that killed trees, and roadsides planted with clover and other forbs. Many birds and other vertebrate species use young forest stands opportunistically for foraging for fruit, arthropods, and browse in these high quality "food patches."

S1.13 JAMES M. VOSE AND CHELCY R. FORD. USDA Forest Service, Southern Research Station. <u>Early Successional Habitat and Water Resources: A Synthesis of the Impacts of Forest Cutting and Other Forest Management Activities on Stream Water Quantity and Quality.</u>

In forested watersheds, streamflow is determined by a combination of biological and physical controls. Vegetation structure and function determine biological controls, while physical controls include variables such as climate, soil depth, groundwater interactions, topography, and soil infiltration rates. Our objectives are: (1) to synthesize existing relationships between early successional vegetation and stream water quantity and quality, (2) discuss biological and physical controls and response patterns, and (3) to use our understanding biological and physical controls to evaluate impacts across time and space. The creation and maintenance of early successional habitat changes vegetation structure and function, and may also alter physical controls. With the use of Best Management Practices (BMPs) that limit the impacts of roads and skid trails, biological responses determine most of the variation in streamflow. In the southern Appalachians, streamflow responses in the first few years after cutting range from +15 to +40 cm yr-1. Responses decline rapidly as vegetation regrows, but considerable variation exists in the rate of recovery. Sapflow provides species-level predictive capabilities and management actions that favor one species over another can be evaluated with regards to potential impacts on streamflow. In terms of water quality, most of the impacts of management activities to create early successional habitat are associated with sediment; however, BMPs limit those impacts.

S1.14 TARA L. KEYSER. USDA Forest Service, Southern Research Station. <u>Creation and maintenance of early successional habitat: implications for carbon management.</u>

Concern over mitigating climate change has created an interest in using forestland to increase the amount of carbon currently being stored by forests and to off-set atmospheric CO2 emissions produced from the burning of fossil fuels. The greatest proportion of total ecosystem carbon is found in the aboveground live biomass and mineral soil pools. Of these pools, the aboveground biomass pool is most affected by forest management. Standing carbon stocks in aboveground tree biomass along with rates of carbon sequestration vary with numerous factors including species, site productivity, stand age, and stand structure. Consequently, the effects of active management on carbon storage and sequestration at a given point in time will be dependent on various physical and biological attributes of the stand. As with any discussion surrounding natural resourcerelated issues, the decision to manage and the method(s) used to manage must be made in the context of trade-offs between the principle management objective and other ecosystem benefits. The same is true in regards to carbon management. Forest management activities including the creation of early successional habitat will have implications for carbon management. Understanding the carbon dynamics of the aboveground live tree pool across a complex landscape may be used to inform decisions regarding trade-offs between management for early successional habitat and carbon storage.

S1.15 DAVE N. WEAR. USDA Forest Service, Southern Research Station. <u>Forecasting the Future – projecting forest type and age class diversity in the eastern upland hardwood forest region.</u>

Multiple forces will jointly determine the trajectories of forest type and age distributions over the next several decades. Natural disturbances, climate change, human uses, and successional change interact to define broad patterns of change in the region. This paper examines forecasts of change in forest conditions over the next fifty years in response to these forces based on empirical forest forecasting models developed for the 2010 RPA Assessment. Patterns of change vary over time and space and are especially sensitive to forecast changes in precipitation and population growth and development within the Southern Appalachians. Total standing biomass is expected to peak and begin to decline early in the projection period. Several shifts among forest types are evident and declines in early successional habitats are forecasted

S2: Conservation in western North Carolina. Organized by Gary Wein (Highlands-Cashiers Land Trust)

S2.1 GARY WEIN. Highlands-Cashiers Land Trust. <u>The elements of conservation in western North Carolina.</u>

The forests of the Southern Blue Ridge are among the world's richest ecological systems for the temperate region. The mountainous topography and past ecological history provide a structure for the development of high biological diversity. This regions ecosystems have been threatened by a 77% increase in development in the last 20 years and with the rest of North Carolina, can expect to see impacts from a 35% increase in population by 2020. Efforts are underway to conserve the natural heritage of the Blue Ridge in NC by a myriad of agencies. In this symposium we will examine some of the efforts by non-profits, state agencies, and private entities to conserve the lands of western NC. This examination will be incomplete, for example there will not be a presentation on efforts to protect agricultural lands from loss. This talk will introduce one of the organizations involved in land conservation, a land trust. Typically a land trust is a nonprofit organization with the mission to actively work to conserve by land or conservation easement acquisition, or by its stewardship of such land or easements. Land is acquired through purchase and often transferred to Federal or State agencies such as the U.S. Forest Service or NC Department of Agriculture. In a conservation easement the land owner still owns their property but donates or sells their development rights to a qualified agency such as a land trust. The process of land purchase and easement donation will be explored as well as the benefits.

S2.2 PHYLLIS STILES. Blue Ridge Forever. <u>Blue Ridge Forever, A Coalition of Land Trusts.</u>

In 2004, ten land trusts joined forces as the Blue Ridge Forever coalition to better serve the 10,000 square mile, 25-county region comprising North Carolina's mountains. Through collaboration they sought to increase public awareness of the region's urgent need for conservation, enhance fundraising, and build each member's capacity. They have collectively protected over 180,000 acres since 1909 and currently monitor over 400 easements each year. The Southern Blue Ridge Mountains represent the biologically richest remaining temperate forest in North America, if not the world, with "specialized habitat for the evolution and persistence of a vast flora and fauna, including over 400 endemic species—the most found in any ecoregion in North America," (*N.C. Wildlife Action Plan,* p. 88). This treasure holds more tree species than all of Europe and more aquatic species than the Pacific Northwest. This rich ecosystem provides a plethora of environmental services and fuels a robust tourism economy. However, it is under grave

threat due to the state's population growth projections--from 8 million in 2000 to 12 million in 2030. Coalition members worked for two years to craft a Conservation Vision for Western North Carolina, which showcases 29 focus areas that met the coalition's rigorous selection criteria. Together, members are sharing information more freely, learning from one another's staff members, and directly collaborating on more projects. The whole is truly greater than the sum of its parts. The coalition's 5-year goal of protecting 50,000 acres by the end of 2010 is within reach.

S2.3 RICHARD ROGERS. North Carolina's Clean Water Management Trust Fund.

<u>Clean Water Management Trust Fund - Protecting, Restoring and Enhancing</u>

Water Quality in North Carolina.

The 1996 General Assembly created the Clean Water Management Trust Fund (CWMTF) "to clean up pollution in the State's surface waters and to protect and conserve those waters that are not yet polluted." Local governments, state agencies, and nonprofit conservation organizations, such as land trusts, may apply for grants. The CWMTF's nonregulatory, incentive-based programs complement NC's environmental regulatory and educational programs and help ensure both a strong economy and healthy environment. The CWMTF is an independent agency housed for administrative purposes in the Department of Environment and Natural Resources (DENR.) A 21-member board of trustees establishes criteria, allocates funds, reviews applications, approves grants, and hires the executive director. CWMTF was created to protect, restore and enhance the surface waters of North Carolina. We at CWMTF have created criteria by which we judge projects and rank their importance as it relates to surface water quality. The importance of accomplishing our mission at CWMTF is only one piece in the puzzle of protecting the states important natural resources. The challenge is bring various conservation efforts together in a way that will allow the multiple goals of resource agencies and funding agencies to be achieved while protecting our natural systems. It is incumbent upon us in the area of natural resource restoration and protection that we use planning and research to set our priorities to protect and restore our natural systems to sustain our wonderful natural heritage and ourselves.

S2.4 EDWARD SCHWARTZMAN. North Carolina Natural Heritage Program. <u>The North Carolina Natural Heritage Program: Inventory and conservation priorities in Macon County.</u>

The North Carolina Natural Heritage Program (NCNHP) works to document and protect the best examples of NC's biodiversity by conducting natural area inventories and cataloging the state's flora and fauna. NCNHP has been carrying out this mission for over 30 years and is presently working to complete inventories in three mountain counties: Macon, Allegheny, and Madison. Through collaboration with land trusts and partner agencies, NCNHP uses its data to promote ecologically appropriate management of natural areas and voluntary protection of private land. NHP data is of critical importance to state conservation-funding organizations, where it is used to assess the relative merit of proposed preservation projects. Macon County, NC is biologically diverse owing to its unique geology, elevation range and landforms, and temperate climate. The county contains numerous rare species and significant natural heritage areas. The Little Tennessee River is a Nationally Significant Aquatic Habitat and home to many endemic species of fish and mussels. The Highlands area of Macon County hosts a number of globally unique habitats including mountain bogs, granitic domes, and old-growth Canada hemlock forest. Red cedar glades of the Little Tennessee River valley are another conservation target. Old-growth cove and upland hardwood forest in the Nantahala and Cowee Mountain Ranges are additional areas of interest. NCNHP is working to complete the inventory and partner with area land trusts on future land protection efforts.

S2.5 KENDRICK C. WEEKS. North Carolina Wildlife Resources Commission. <u>North</u> Carolina Wildlife Action Plan: Wildlife Conservation Strategies.

In 2001, the U.S. Congress passed new conservation funding legislation to assist states for development and implementation of projects to benefit wildlife and their habitats. To be eligible for State Wildlife Grants, states were required to develop State Wildlife Action Plans by 2005 to identify species of most conservation need (priority species) and their habitats, identify threats to priority species and their habitats, foster partnerships with the multiple organizations that affect and are affected by wildlife conservation in the state, and provide a structure for evaluating efforts and revising the plan. The North Carolina Wildlife Action Plan was developed in coordination with wildlife experts across the state from many different agencies and organizations. State Wildlife Grants have allowed expansion of the North Carolina Wildlife Resources Commission Wildlife Diversity and Aquatic Diversity Programs to more adequately fill in knowledge gaps and achieve more wildlife conservation than would be achieved by relying solely on the completely volunteer funded North Carolina Non-game and Endangered Wildlife Fund. Conservation strategies addressed in the North Carolina Wildlife Action Plan that have been implemented over the past five years include initiating and expanding reptile and amphibian surveys, promoting green infrastructure and urban planning, filling knowledge gaps with research on priority species, and protecting and managing sensitive habitat. I will highlight some of the most significant achievements so far and the wildlife conservation issues that will be a focus of future efforts.

S2.6 LORI A. WILLIAMS. North Carolina Wildlife Resources Commission. Conservation of the green salamander (*Aneides aeneus*).

Listed as endangered in North Carolina, the green salamander is a habitat specialist relying heavily on suitable crevices in shaded rock outcrops for reproductive success, overwintering, foraging, and cover throughout the year. This species is found in two disjunct areas in the state and is considered a conservation priority in the North Carolina Wildlife Action Plan (2005). Evidence suggests that two decades ago the green salamander population dropped dramatically, causes unknown. Researchers began concerted efforts in the late 1990s to document extant populations and new locations for this species. For the past eight years, the North Carolina Wildlife Resources Commission has tripled the number of known green salamander locations and documented consistent detection probability (81-86%). These data suggest a more stable population now than in previous decades. In 2009 we began a long-term study to examine effects of prescribed fire on green salamander habitat and populations. Staff and project partners continue to monitor historical sites each year, identify new sites, work with land trusts to protect habitat, and provide technical guidance to landowners and agencies regarding the habitat needs of this species. Applied research, along with continued population monitoring and project partnerships to conserve habitat, will help ensure the future of green salamanders in North Carolina.

S2.7 CHRIS KELLY. North Carolina Wildlife Resources Commission. <u>Conservation of</u> the endangered Carolina northern flying squirrel in North Carolina.

North Carolina Wildlife Resources Commission manages conservation efforts for the endangered Carolina northern flying squirrel in western North Carolina. The objectives of the conservation program are to fill in distribution gaps, monitor populations over time, and protect habitat. Nest box transects have been established in seven geographic recovery areas, and inventory work is underway outside of recovery areas. Since 1996, NCWRC has expanded the known range of the northern flying squirrel, conducted annual nest box checks, and captured, tagged, and released 1,005 northern flying squirrels. The annual nest box survey for the Carolina northern flying squirrel has problems with low captures,

low recaptures, and tag loss. In response, NCWRC is modifying the program by shifting from monitoring abundance of individuals over time to monitoring occupancy of habitat over time. Simulations in program PRESENCE, using known occupancy rates and detection probabilities for the North Carolina population, provide guidance on the level of future monitoring needed to detect trends in occupancy. Examples of habitat protection efforts include development of a habitat model for two geographic recovery areas and installation of crossing structures to reconnect a population divided by a road barrier.

S2.8 DAVID TUCH. Equinox Environmental Consultation & Design, Inc. <u>Conservation-based development in Western North Carolina</u>.

Over the past 10 years Equinox has been pursuing resource conservation and sustainable development in the western North Carolina region. Design criteria have focused on preservation, conservation, and ecological factors that address the development pressures on farmland, forestland, and natural & cultural resources. Natural resources within a residential development can be protected by using elements of planning, landscape architecture, ecological, and conservation biology. The presentation will include the patterns of traditional development and patterns suitable for conservation developments, a five step planning process, and case studies. The case studies utilize principles of conservation ecology to protect plant and animal biodiversity, wetlands, riparian corridors, forests, and rare species. One of the case studies, Drovers Road Preserve is an award winning project serving as a model for sustainable development in the region. Based on the McHargian layering process a detailed inventory was performed to identify the lands to be protected through a conservation easement and lands suitable for homesite development. The planning and design techniques implemented in several of the case studies include: conservation of habitat, innovative stormwater management practices, appropriate infrastructure design such as roads and parcel layout to minimize construction impacts, and enhancement/restoration of habitat.

ASB Oral Session Abstracts

O1.1 DOUG HORCHLER¹, JEFF HUMPHRIES², AND THOMAS PAULEY³ Marshall University¹, North Carolina Biological Commission², Marshall University³. Longterm growth and monitoring of the Eastern Hellbender (*Cryptobranchus a. alleganiensis*) in an Eastern West Virginia stream.

Amphibian declines have been well documented, specifically in the last few decades. The Hellbender, Cryptobranchus alleganiensis, one of North America's largest salamander species, has suffered dramatic declines throughout much of its range, with estimated declines of up to 77 percent recently documented in some populations. Through the use of area constrained searches and mark-recapture techniques, we collected data on the status of Eastern Hellbender populations in Eastern West Virginia. We re-sampled a West Virginia study site first examined in 1998 by Jeff Humphries. Long-term growth and survivorship data will be collected and compared to 1998 data. As there is currently no long-term (>10 years) growth data on Eastern Hellbenders. I am interested in the growth of recaptured animals eleven years later. Of the 29 hellbenders tagged within the West Fork site in 1998, 11 were recaptured in 2009. Eleven year mean growth of recaptured hellbenders is 3.43 cm (range 0.6cm - 4.5 cm, n=11). A notable demography shift in both sex and size occurred from 1998 to 2009. In 1998 the population exhibited a 1.1:1 sex ratio, while the 2009 population exhibited a 2.1:1 ratio. A marked shift in size class was noted, with 2009 exhibiting shifts to larger size classes. However, evidence of reproduction was found in 2009 where it was lacking in 1998, suggesting a relatively stable population. This recapture data will allow the development of a growth/age model for adult salamanders. This is valuable, as age estimates for these large size class animals are poorly understood.

O1.2 ANDREW T. COLEMAN¹, THANE WIBBELS¹, YU-HUI HUANG¹, KEN MARION¹, AND JOHN DINDO², NICOLE WHITE³. University of Alabama at Birmingham¹, Dauphin Island Sea Lab², Birmingham Southern College³. Effect of female age and size on egg size and hatchling growth in the Mississippi diamondback terrapin, Malaclemys terrapin pileata, and potential conservation implications.

Throughout their range, populations of diamondback terrapins, *Malaclemys terrapin*, are experiencing declines from historic levels due to a number of threats. Along the Gulf Coast of Alabama, only isolated remnant aggregations exist in areas where once a large terrapin farm existed. To address the high amount of nest predation by raccoons, a head start program was initiated at U.A.B. The ultimate goal of the head start program is to ensure the future survival of diamondback terrapins in Alabama. However, obtaining terrapin hatchlings has offered an opportunity to further study the species' biology, including relationships between female and hatchling physiology and fitness. In the summer of 2009, twelve clutches for a total of 94 eggs (average of 7.4 eggs/clutch) were obtained from nesting females. The length, width, and mass of every egg were measured. After hatching, carapace length and width, plastron length, and mass of every hatchling were measured once a week. The effect of female age and size on both egg size and hatchling growth was examined. Rate of hatchling growth was treated as an indicator of hatchling fitness. So do larger females produce more fit hatchlings? The answer to this evolutionary question has obvious conservation implications for populations facing extirpation.

O1.3 MICHELLE L. GUIDUGLI AND STEPHEN C. RICHTER. Eastern Kentucky University. Reproductive and spatial ecology of an ephemeral pond-breeding amphibian community.

For many amphibian species the temporal and spatial patterns of migration are poorly understood. To better understand these processes, an ephemeral pond-breeding amphibian community was studied at Central Kentucky Wildlife Management Area, Madison County, Kentucky. The study pond was completely encircled using a drift fencepitfall trap array and checked continually from January to October 2009. Meteorological and habitat data were measured to determine their influence on the timing and orientation of amphibian migrations. Although several amphibian species inhabited the study pond, Ambystoma jeffersonianum (Jefferson's Salamander) and A. maculatum (Spotted Salamander) were dominant in their abundance and length of time they occupied the pond for breeding. Breeding migrations of these species were explained by increased daily cumulative precipitation, mean air temperatures, and maximum changes in barometric pressure. Exiting migrations were primarily explained by warmer air temperatures in the winter and early spring for adults and mild summer air temperatures and increased rainfall for A. maculatum metamorphs. Entering migrations were non-randomly orientated for A. jeffersonianum and A. maculatum adults; however, exiting migrations were only nonrandomly orientated for A. maculatum adults and metamorphs. Entering movements were weakly associated with distance to forest edge; however, A. maculatum exiting migrations were more strongly explained by distance to forest edge. These results exemplify how closely movements of amphibian species are linked to their environment. Amphibian populations are declining due to habitat destruction and fragmentation; therefore, this understanding of when and where different aspects of their habitat are used will aid in future conservation and land management.

O1.4 SAMUEL R. HOLCOMB AND JOHN L. CARR. University of Louisiana at Monroe. Survivorship and Causes of Mortality in Nests of the Alligator Snapping Turtle (*Macrochelys temminckii*) in Northern Louisiana.

The Alligator Snapping Turtle, Macrochelys temminckii, is a species of conservation concern throughout its range, and is considered rare and localized in Louisiana, with a state rank of S3. Macrochelys temminckii exhibits high adult survivorship, with most mortality occurring during the egg stage. It is therefore necessary to understand the sources of nest mortality in order to better manage for this species. Research into survivorship and causes of mortality of M. temminckii nests was conducted during the 2008 and 2009 nesting seasons at Black Bayou Lake NWR, Louisiana. Nest surveys were conducted daily during the nesting season, and all nests found were processed and equipped with nest protectors. Nests were then monitored in situ to determine both hatching and emergence success, and to document causes of nest failure, in the absence of mammalian depredation. Hatching success of eggs was at least 30% for the two years combined, with a minimum emergence success of 21%. In parallel, artificial nest experiments were conducted utilizing cameras to document depredation events. Ninety artificial nests were constructed over the two year study, with a 100% depredation rate. Photos of predators were obtained at 51 of the 90 nests, with the raccoon, Procyon lotor, being the most frequent predator identified.

O1.5 LISA R. CANTWELL AND T. G. FORREST. University of North Carolina at Asheville, Response of *Anolis sagrei* to Acoustic Calls of Predatory and Non-Predatory Birds.

Predation is one of many selective forces driving evolution in prey organisms. Studies indicate that vertebrates and invertebrates use sensory cues to recognize predators and evaluate predation risk. Lizards and birds frequently inhabit the same ecosystems; consequently, avian predation on lizards has been implicated as an important selective pressure on lizard behavior. However, no studies have been conducted on anole response to non-visual cues. Male anoles exhibit characteristics that increase their vulnerability to predatory birds including conspicuous coloration and behavioral displays. They also posses well developed auditory systems with enhanced directionality. Interestingly, lizards are non-vocal animals and therefore their auditory systems must function for something other than intraspecific communication with likely functions including the detection of prey or predators. The response of adult male brown anoles (Anolis sagrei) to calls of birds was studied to determine whether they use auditory cues as an indicator of predation risk from birds. Anole responses varied among stimuli and were significantly dependent on the stimulus presented. Anoles reacted with anti-predator behavior more often to high risk stimuli compared to non-threatening stimuli. Anoles responded significantly more often with head tilt, suggesting predator recognition, during playback of predatory vocalizations than to low risk stimuli. Results indicate that anoles distinguish predatory from non-predatory birds by means of acoustic cues.

O1.6 CASEY R. BRADSHAW AND THOMAS K. PAULEY. Marshall University. <u>Effect of Snakes on Cheat Mountain Salamander (Plethodon nettingi)</u> Due to Forest Fragmentation.

Forest fragmentation is one of the main causes for the loss of native biodiversity. One consequence is increased proportion of edge habitat that introduces new "edge" species, and makes habitat for interior forest-living species less-suitable. The study was conducted at three sites in Tucker County, West Virginia and included one downhill ski slope, one cross country ski slope, and one gravel road. The main objectives of this study were to determine species richness and relative abundance of snake communities, how far species move from edge habitat into the forest and to determine whether snakes are a predatory threat to the federally protected Cheat Mountain Salamander. Area constrained surveys were conducted at each site from June through mid-October 2009. Three transects were placed at each study site and a vegetation analysis was conducted to quantify changes in plant communities. Snakes found were measured for snout-to-vent

length and total length, gender was determined and each specimen marked for recapture data. Preliminary results show that the majority of snakes are found along the forest edge under cover objects where direct sunlight heats the ground/rocks. The highest concentration of salamanders was found along transects deeper into the forest, although some were found along the edge. Snake species included Northern-Ringnecked Snake (Diadophis punctatus edwardsi), Red-bellied Snake (Storeria o. occipitomaculata), Eastern Gartersnake (Thamnophis s. sirtalis) and Smooth Greensnake (Opheodrys vernalis), all of which include a diet of salamanders to some extent.

O1.7 KYLE PURSEL AND JOSEPH PECHMANN. Western Carolina University. <u>Great Laurel (Rhododendron maximum)</u> effects on microhabitat use and abundances of Southern Appalachian salamanders.

The Southern Appalachian Mountains have the highest diversity of salamanders in the world, particularly of lungless salamanders of the family Plethodontidae. Lungless salamanders rely on their skin to breathe, and are highly susceptible to environmental changes. Invasive species are capable of dramatically altering environments and decreasing biodiversity. Rhododendron (Rhododendron maximum, a native invasive shrub) is considered by some to be a native invasive; a native species that, due to human influence, is expanding within its range and is negatively impacting and altering ecosystems. Spread of rhododendron is associated with fire suppression and intensive logging. Rhododendron forms dense thickets, alters environments, and decreases plant diversity, but its impacts on animal species are poorly understood. I measured salamander abundance and diversity, plant diversity, and litter arthropod abundance and diversity within rhododendron-dominated and control plots at each of five sites in the Nantahala National Forest, NC. Sites were surveyed for salamanders monthly July to August at night using area-constrained searches, and once each for litter arthropods and plants. On average, 30% fewer salamanders and 38% fewer *Plethodon shermani*, the most common salamander encountered, were captured in rhododendron-dominated plots than in control plots. Understory plant diversity and abundance were also reduced under rhododendron thickets. Management of dense rhododendron thickets may be needed to preserve at risk communities in the Southern Appalachians.

O1.8 ALEX EDWARDS¹ AND CARLOS D. CAMP². Piedmont College. <u>The Relationship between Environmental Variables and Geographic Variation in the Timber Rattlesnake (*Crotalus horridus*).</u>

The wide array of morphological variations in the timber rattlesnakes (*Crotalus horridus*) has been the subject of much discussion, most of which has centered on taxonomic implications of geographic variation and the validity of described subspecies. We explored potential patterns of morphological traits to discern if morphological variation is related to climatic and/or physiographic variables. We ran a variety of statistical analyses to see if mean annual temperature, elevation, mean annual precipitation, soil-particle size, or shade abundance is related to morphology. Dorsal-scale number was positively related to temperature whereas ventral and sub-caudal scale counts, blotch size, and blotch spacing were all negatively related to elevation. Background body color and head color could be explained by a complex interaction between temperature and elevation. Other color variation was affected by shade fraction. These data show that morphological variation in *C. horridus* is strongly related to climatic and physiographic factors. In particular they provide strong evidence that the role of pigment on thermoregulation has a significant effect on the morphological variation exhibited across the range of *C. horridus*.

O1.9 MITCHELL RAY AND JOHN L. CARR. University of Louisiana at Monroe. <u>Spatial Ecology of Adult Alligator Snapping Turtles (Macrochelys temminckii) in Northern Louisiana</u>.

The Alligator Snapping Turtle (Macrochelys temminckii) is a secretive aquatic turtle found in swamps, rivers, and lakes of Gulf Coast drainages in the southeastern United States. We are conducting a radio-telemetry study of adult M. temminckii at Black Bayou Lake National Wildlife Refuge in Ouachita Parish, Louisiana. We have attached external ATS radio-transmitters to 21 adult M. temminckii (12 male, 9 female) captured in Black Bayou Lake. Relocations have been recorded since April 13, 2008 and were completed January 31, 2010. Temperature was measured at each relocation site; however, habitat measurements are difficult because the margins of the lake where the turtles spend the majority of their time are covered in floating vegetation mats, comprised primarily of Alternathera philoxeroides, Ludwigia urguayensis, Eichornia crassipes., and Typha latifolia. Submergent vegetation, especially Egeria densa and Ceratophyllum demersum, is also abundant. As a consequence, relocations were triangulated using Locate III software in the field. Currently, 1102 position fixes have been recorded. Data will be presented on the seasonal pattern of movement for males and females. In addition, we hypothesize that adult turtles occupy certain core areas and that male and female home ranges differ in size.

O1.10 KATIE MURPHY, JAYME WALDREN, AND THOMAS PAULEY. Marshall University. The Effects of Roads and Trails on Terrestrial Salamander Movement Patterns.

The negative effects of roads on wildlife populations has been well documented, including road mortality, genetic isolation and the introduction of invasive species. Amphibians and reptiles are particularly affected by these barriers, which can prevent short and long distance movement. Much of the research done on amphibians has been done on *Ambystoma*, which cross roads in mass during breeding season, or on *Plethodon cinereus*, due to its widespread occurrence and abundance. Plethodontid salamander are greatly affected by the edge effects of roads and trails within their habitat.

The *Plethodon nettingi* is one such species with a recorded history of trail and road advoidance. *P. nettingi* is a federally protected species that occurs only in the high elevations of north- central West Virginia. This study was performed within the Monongahela National Forest, where a large portion of the *P. nettingi* population is found. The objective of this study was to determine the effect of several trail types (gated road, high-use trails and medium-use trails) on the movement patterns of *P. nettingi* and other commonly occurring Plethodontids. Florescent pigment powder was used to track the salamanders. The salamanders were dipped during the day, then their trails were followed at night using a black light. Twenty sites over the course of four months were monitored, including five replicates of each treatment and a control. Preliminary results show a general avoidance of trails. This research will be used by the U.S. Forest Service to understand the natural movements of understudied terrestrial salamanders.

O1.11 SARAH E. MILOSKI¹, JAYME L. WALDRON², AND THOMAS K. PAULEY¹. Marshall University¹, University of South Carolina². Movement patterns and artificial arboreal cover use of Green Salamanders (*Aneides aeneus*).

Global amphibian declines have spawned a need for amphibian monitoring studies using standardized sampling techniques for early detection of population declines. The Green Salamander (*Aneides aeneus*) is a declining plethodontid salamander associated with rock outcrops and arboreal habitat. The unique habitat requirements of this species make Green Salamander populations particularly susceptible to habitat perturbations. Although primarily associated with rock outcrops, Green Salamander morphology and ecology suggest that Green Salamanders may be highly mobile, which has important implications for habitat management, particularly pertaining to land surrounding rock outcrops. However, few studies have addressed plethodontid movement patterns, which are

fundamental to understanding the ecology of a species and provide vital information for conservation initiatives. Thus, I investigated Green Salamander movement patterns in Kanawha County, West Virginia. Specifically, my objectives were to 1) use fluorescent powder to quantify daily movement patterns, and 2) assess the efficiency of using artificial cover (i.e., burlap) in Green Salamander monitoring protocols. I conducted nocturnal and diurnal surveys of six study sites. I applied fluorescent powder to Green Salamanders and tracked movement within 24 hours. Preliminary results include a maximum distance traveled by an individual of 14.7 m out of 36 tracked individuals. Four individuals used artificial cover throughout 131 surveys. Information gathered from this study will afford valuable data on plethodontid movement in general, while providing information for effective management of Green Salamander habitat.

O1.12 AARON C. GOOLEY¹, JAYME L. WALDRON², AND THOMAL K. PAULEY¹. Marshall University¹, University of South Carolina². <u>Testing the Behavioral Responses of West Virginia Turtles to Roads and Vehicles.</u>

Road mortality has been identified as a major threat to many turtle species; however, road crossing speed, road avoidance, response to passing vehicles, and general behavior while crossing roads has never been investigated in turtles. To investigate these factors, Midland Painted Turtles (Chrysemys picta marginata), Eastern Box Turtles (Terrapene c. carolina), Stinkpots (Sternotherus odoratus), Common Snapping Turtles (Chelydra s. serpentina), and Wood Turtles (Glyptemys incsculpta) were collected and placed in a release box on the side of a closed road, released via a pulley-operated door facing the road, and its actions videotaped by an observer in a nearby blind. A vehicle was driven past crossing turtles to simulate passing traffic. Prior to each trial, road surface temperature, air temperature and relative humidity at ground level, and percent cloud cover were recorded. The resulting videos were used to determine the time each specimen took to cross the road, frequency and length of pauses, angle of crossing, and the type and length of response to a passing vehicle. Following trials turtles were released at the original point of capture. Preliminary results show that aquatic turtles move more quickly on roads than terrestrial species and most turtles react to passing vehicles by ceasing to move. Future trials conducted in the spring and summer of 2010 will include additional species and expand sample size.

O1.13 STEVEN J. PRICE^{1,2}, MICHAEL E. DORCAS² AND ROBERT A. BROWNE¹. Wake Forest University¹, Davidson College². <u>Stage- and species-specific responses of stream salamanders to urbanization.</u>

Urbanization has become the most ubiquitous form of land-use disturbance in the southeastern United States and represents a significant threat to stream ecosystems and biota. Using a before-after, control-impact study design, we investigated the effects of urbanization on larval and adult stages of two species of stream salamander by estimating changes in site occupancy one year before and four years after urbanization of 13 of 30 surveyed stream catchments. Annual site occupancy rates were calculated using multiyear Bayesian hierarchical models that account for imperfect detection, and thus provide unbiased parameter estimates. Prior to urbanization, adult and larval stages of two-lined salamanders (Eurycea cirrigera) and northern dusky salamanders (Desmognathus fuscus) occupied nearly all surveyed streams. We found negative effects of urbanization on occupancy rates of larval and adult two-lined salamanders, with mean occupancy rates four years post-urbanization of 0.57 for larva and 0.39 for adults. Site occupancy estimates of larval northern dusky salamanders also decreased to 0.57 four years after urbanization of stream catchments, however adult northern dusky salamander occupancy rates remained stable in urbanized streams over the five-year period. Our study indicates that initial responses of stream salamanders to urbanization of stream catchments vary between stages, with larval stages being particularly susceptible. Our data also suggest that some salamander species, such as the two-lined salamander, which have long larval periods and prefer terrestrial non-breeding habitats as adults, appear to be especially sensitive to urban development within stream catchments.

O1.14 KEVIN MESSENGER. Marshall University. <u>Nocturnal snake activity as it relates</u> to moon phase.

Predicting snake activity can be especially erratic (due to behavior). Countless abiotic factors influence snake behavior such as temperature, solar radiation, wind, humidity, time of day, and season; biotic factors affect behavior even further (sex, species, age). The ability to predict activity levels can provide an improved understanding of behavior and further the efficiency of ecological surveys. The goal of this study is to investigate snake activity patterns as they pertain to factors that influence snake behavior. I monitored nocturnal snake activity, which removed the effects of direct solar and reflective radiation, with respect to the percent of the illuminated disk of the moon. A full moon emits a significant amount of light, which makes it easier for nocturnal predators to detect and prey on snakes. For these reasons, and given that no other influences are taken into account I hypothesized that the greater the percent of the illuminated disk (while the moon is waxing), the less snake activity would be observed. The data supported the hypothesis, revealing a high correlation between moon phase and snake activity. However, the relationship between moon phase and activity is complex; during the waning periods, a large moon causes snakes to condense their activity to a few hours. Periods where there is little to no moon influence, activity may be sparse throughout the night, making surveys less efficient. Moon phase interaction with snake activity is unique, poorly documented, and far more complex than first thought.

O1.15 CARLY NEILSON, LACY DANIKAS, AND VINCENT COBB. Middle Tennessee State University. Effect of substrate on the locomotor performance of recently-fed northern watersnakes.

Snakes, unlike most animals, do not masticate their food (i.e., they swallow their prey whole). This results in food remaining in the stomach for a prolonged period. Additionally, snakes often eat infrequently and commonly eat prey that is a large percentage of their body weight. This raises the guestion of does food intake influence the locomotor ability of snakes? Using 10-12 week old Northern Watersnake (Nerodia sipedon) as our model, we investigated whether recently-fed watersnakes moved slower and if locomotor ability varied by substrate type (i.e., terrestrial vs aquatic). Maximal crawling and swimming speeds were measured using a 2 m racetrack lined with photocells at 0.5 m intervals. Locomotor tests were replicated using three treatments: before feeding, 3-4 hours post feeding, and 1 day post feeding. For all treatments, snakes were faster in the aquatic trials than in the terrestrial trials. Within the aquatic trials, maximal swimming speeds did not differ between treatments. The lack of difference in the aquatic environment is likely due to the buoyancy of water and reduced friction, which can increase locomotor speed. However for terrestrial trials, both post-feeding treatments resulted in significantly slower crawling speeds. Because of potential negative anti-predator effects on recently-fed individuals, snake habitat selection could potentially vary with digestive state. Additionally, selection pressures favoring rapid swimming speeds, even with a full stomach, may have occurred.

O2.1 RALPH L. THOMPSON¹ AND STEPHANIE R. GrEEN². Berea College Herbarium¹ Southwest Florida Water Management District². <u>Vascular flora and plant habitats of Camp Nelson Quarry, an abandoned limestone quarry in Garrard County, Kentucky</u>.

A descriptive survey of the vascular flora was conducted on the Camp Nelson Quarry, a 2.3-ha limestone guarry abandoned since 1991 in Garrard County, Kentucky. Collections from this site during 1996, 1997, 2000, 2003, and 2004 resulted in an annotated plant list of 209 species in 155 genera from 61 families. The known vascular plants of the guarry included one species of Equisetophyta, one species of Pinophyta, and 207 species of Magnoliophyta (45 Liliopsida, 162 Magnoliopsida). A total of 137 taxa (65.55%) were native and 72 (34.45%) were non-native. Of the exotics, 34 were considered invasive pest plants in Kentucky with Lonicera maackii (Rupr.) Maxim. the most aggressive naturalized plant. Thirty-four (16.27%) of the taxa were woody, while 175 (83.73%) were herbaceous. In 13 years of disuse, plants have colonized nine anthropogenic habitats in the quarry through progressive secondary succession: vertical highwalls, talus slopes, spoil heaps, dry quarry floor, old-field succession area, wet quarry floor, wet ditch border, seasonal pond area, and permanent pond area. Sørenson's Similarity Indices were significant between Camp Nelson Quarry and two older and smaller abandoned limestone quarries. Species richness is expected to increase in the Camp Nelson Quarry as more plants colonize and become established and soil development and progressive secondary succession continue through time.

O2.2 LINDSAY LEVERETT AND MICHAEL WOODS. Troy University, Troy, AL. <u>The genus Crotalaria</u> (Fabaceae) in Alabama.

Crotalaria Linnaeus, commonly known as rattlebox, is a member of the legume family Fabaceae (Leguminosae) and the tribe Crotalarieae. The genus consists of approximately 600 species worldwide. Eighteen species have been reported from the United States. Of these, 14 species have been reported from the southeastern United States and eight species have been reported from Alabama. Based on the results of this study, seven species of Crotalaria occur in Alabama. The most common species of Crotalaria in the state is C. sagittalis, represented in 40 counties. Crotalaria rotundifolia and C. spectabilis are each represented in 36 counties. The least common species are C. purshii (15 counties), C. lanceolata (seven counties), C. pallida (three counties), and C. ochroleuca (three counties). Dichotomous keys and descriptions are modifications from earlier authors; however, all measurements are based on morphological features of the vegetative and reproductive structures of the plants studied during the project. Data for the distribution maps were gathered from personal collections and plant specimens deposited in the herbaria of Troy University (TROY), J. D. Freeman (AUA), The University of Alabama (UNA), The University of South Alabama (USAM), Anniston Museum of Natural History (JSU), University of North Alabama (UNAF), and Southern Methodist University (SMU) and Vanderbilt University (VDB), both of which are housed at the Botanical Research Institute of Texas (BRIT) in Fort Worth.

O2.3 RONALD JONES¹ AND HUMBERTO JIMENEZ-SAA². Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475¹, and Tropical Science Center, San Jose, Costa Rica². <u>Additional notes on the woody flora of the Valle de El General</u>, southern Costa Rica.

A 4-month floristic study in southern Costa Rica was conducted in 2007, followed by a 1-month study in 2008 and a 2-week study in 2009. The purposes of these studies were to document the woody flora of the region, including any rare or unusual species, and to provide an updated account of the status of forested lands in the valley of the General River. A total of about 750 sets of specimens have now been collected, mostly in triplicate, with sets deposited at the *Herbario Nacional* in San Jose, at the Tropical Science Center in San Jose, and at the Eastern Kentucky University Herbarium. While the 2007 study focused on *Los Cusingos*, a bird sanctuary with elevations ranging from 650 to 750 m, the 2008 and 2009 studies focused on other sites at varying elevations in the *Valle de El*

General. Differences in the woody plant flora were noted at the different elevations, and the condition of the forests was documented by notes and photographs. Extensive sets of photographs were also taken of most species collected during the study. Much of the region has now been deforested, and naturalized exotic species are common in some areas. The recent introduction of industrialized pineapple farming has increased pressures to clear more forested lands. Some areas remain forested and government-protected, and these, together with lands owned by conservation-minded private individuals and agencies, continue to provide sites for botanical studies in the region.

O2.4 EMILY JEAN HICKS¹, ROBERT F.C. NACZI¹, and PAT CALIE¹. Eastern Kentucky University¹, and the New York Botanical Garden². <u>Insights into the generic relationships within the family Sarraceniaceae (Ericales)</u>.

The flowering plant family Sarraceniaceae contains three genera: the North American Sarracenia (11 species) and monotypic Darlintonia, and the South American Heliamphora (upwards of 16 described species). A relative paucity of informative morphological characters has rendered efforts at resolving evolutionary relationships in the group problematic. Prior efforts by others involving molecular data involved the nuclear ITS region and the plastid *rbcL* gene, with some conflicting results. We are utilizing a different molecular data set in an effort to resolve the evolutionary relationships among the three genera and to provide insights into the possible biogeographic origin of the group (i.e. either western North America, the southeastern United States, or South America). Three loci have been successfully amplified through the PCR from genomic DNA samples of Darlingtonia californica, four Heliamphora species, six Sarracenia species, and one sample each of the outgroups Actinidia (Actinidiaceae) and Roridula (Roridulaceae). An analysis of the P-distances of available Sarraceniaceae GenBank sequences, using PAUP*, demonstrated that the most useful loci would be the nuclear 26S rRNA largesubunit (LSU) gene (1.5-4.1% sequence variability in pairwise comparisons), the plastid intron maturase-encoding gene matK (7.5-10.5% variability) and the mitochondrial maturase-encoding gene matR (1-3.3% variability). Our current data set consists of the entire matR (1700 bp) and matK (1900 bp) genes, and approximately 92% of the 26S rRNA gene (3000 bp). The final concatenated data set will be analyzed using both Maximum Parsimony and Maximum Likelihood in an effort to obtain a well-supported phylogeny at the generic level.

O2.5 WAYNE BARGER¹, BRIAN HOLT¹, AND ALAN CRESSLER². ¹State Lands Division, Natural Heritage Section, AL-DCNR, ²U.S. Geological Survey, Atlanta, GA 30360. <u>Asplenium abscissum Willd.</u> (Cutleaf Spleenwort) New to Alabama.

Known previously from seven central and south Florida counties in the continental U.S., *Asplenium abscissum* was recently identified growing in a vertical cave entrance in northeastern Alabama (Jackson County.) The population of this lithiphilic fern is approximately 800 km (500 mi) from the next closest known population near Gainesville, Florida (Alachua County). This constitutes a state record and an extremely disjunct population for the normally tropical/subtropical fern species.

O2.6 RICHARD A. MATTHEWS¹ AND KERRY D. HEAFNER². Old Dominion University¹, Louisiana Purchase Gardens and Zoo². *Isoetes austro-caroliniana*, a new quillwort from upstate South Carolina.

Historically, three diploid (2n=22) *Isoetes* species have been recognized as occurring on the much-studied granitic outcrops of the southeastern U.S. Piedmont region. *Isoetes melanospora* Engelmann and *I. tegetiformans* Rury, are diminutive, federally-endangered species that produce black megaspores. *Isoetes piedmontana* (Pfeiffer) Reed, produces white megaspores, and may occur syntopically with either previously mentioned species,

and is often a common member of an assemblage of plants found in moss-covered seeps along outcrop margins. Here, we assign the name *Isoetes austro-caroliniana* to a diploid population in Lancaster County, South Carolina (40 Acre Rock), once hypothesized to be the result of introgression. Indeed, plants in this population exhibit morphological features intermediate between *I. piedmontana* and *I. melanospora*, as supported by Principal Components Analysis (PCA). A preliminary Discriminant Function Analysis (DFA) revealed that five of six 40 Acre Rock collections (83%) were classified as distinct from either *I. melanospora*, *I. piedmontana*, or *I. tegetiformans*. One 40 Acre Rock collection was classified as *I. piedmontana*. DNA sequence analyses of the second intron of a LEAFY homolog suggest an alternative origin, and a possible involvement as a parent of the Chesterfield County, Virginia population in the tetraploid *Isoetes hyemalis* species complex.

O2.7 TYLER W. SMITH¹ and MARCIA WATERWAY². ¹Eastern Kentucky University, ²McGill University. Species delineation and niche evolution in the *Carex roanensis* (Cyperaceae) complex.

Carex roanensis is a globally rare sedge, first described in 1947. Morphologically, it is very similar to *C. virescens* and *C. aestivalis*, and it often occurs together with these species in rich forests in the southern Appalachians. We combined morphological and molecular (AFLP) data to clarify the taxonomic distinctions between them. This analysis confirmed the taxonomic validity of *C. roanensis*. To assess the ecological distinctions among these species, we combined ecological field data, herbarium records, and climate data. Our results show that while these species do frequently co-occur, each of their niches encompass environmental conditions outside the range of the other species. Extending the study to include five other closely related species suggests that niche evolution in this group has proceeded by gradual divergence within broad habitat categories, rather than abrupt radiations into disparate niches.

O2.8 ASHLEY B. MORRIS¹, CATHERINE H. GRAHAM², DOUGLAS E. SOLTIS³ AND PAMELA S. SOLTIS³. University of South Alabama¹, Stony Brook University², University of Florida³. Everything but the kitchen sink: new phylogeographic analyses in Fagus grandifolia.

Patterns of phylogeographic diversity in eastern North America have been well documented, with suggestions of Pleistocene refugia in both coastal and interior regions. However, most studies to date have only qualitatively assessed these patterns, largely through visual observation of haplotype networks. Additionally, many plant studies use only one or two individuals per locality, which likely limits recovery of haplotype diversity. The aim of this study is to address the issues of sampling strategy and quantitative assessment of phylogeographic patterns in an eastern North American tree, Fagus grandifolia. Comparing two sampling strategies (more localities with lower sample size within localities vs. fewer localities with increased sample size within localities), we analyzed chloroplast DNA sequence data from more than 230 individuals across 130 localities using statistical parsimony, maximum parsimony, maximum likelihood, and Bayesian analyses. We then assessed support for inferred phylogenetic relationships using Monmonier's algorithm and AMOVA. As an additional test of biogeographic hypotheses, we employed ecological niche models (ENMs) of present and palaeodistributions. Finally, we will use statistical phylogeography to further assess the robustness of alternative hypotheses. More haplotypes were recovered when more localities were sampled, but novel haplotypes and haplotype distributions were recovered using both strategies. Analyses resulted in conflicting results regarding coastal vs. interior refugia, emphasizing the complexity of the problem at hand. We propose that future phylogeographic studies follow a step-wise sampling strategy, balancing cost and expected outcomes.

O2.9 JAMES B. BECK AND MICHAEL D. WINDHAM. Duke University. <u>Microsatellites as tools for species delimitation in recently-diverged flowering plant groups; an example from Boechera (Brassicaceae)</u>.

Studies of flowering plant genera and species complexes are frequently hampered by a lack of sequence divergence at commonly utilized DNA loci due to the relatively young age of these lineages. One potential solution involves the sequencing and analysis of large numbers of loci, a strategy that is time consuming, expensive, and computationally intensive. If the aim of the study is species delimitation rather than phylogeny reconstruction, the analysis of microsatellite, or simple sequence repeat (SSR), variation is a relatively quick, inexpensive, and computationally straightforward alternative. The key is the relatively low level of intra-group sequence divergence itself, which includes limited genetic change at microsatellite priming sites. Primers developed for a single exemplar species are therefore often amplifiable across much of the target group. Other advantages include the low per-individual cost relative to sequencing, obtaining genomic rather than single-locus information, and the wealth of analytical tools appropriate for species delimitation with microsatellite data. An example in the recently-diverged genus *Boechera* is presented.

O2.10 SHAW, JOEY¹, JUN WEN², IAN COHEN¹, ROSMARIE HABERLE³, CHIN SIEW-WAI³, AND DANIEL POTTER³. The University of Tennessee at Chattanooga¹, The Smithsonian Institution², The University of California at Davis³. Chloroplast DNA phylogeny of *Prunus* L. (Rosaceae) using *trnS-trnG-trnG*, *psbA-trnH*, *trnL-trnL-trnF*, and matK cpDNA Sequences.

Prunus L. (Rosaceae), comprising roughly 200 woody species, includes several economically important fruit and nut crop species of temperate regions, such as plums/prunes, peaches, cherries, and almonds, as well as many ornamental species and numerous wild species of ethnobotanical importance. Prunus is mostly distributed throughout the north temperate regions of the world, but there are some tropical species of Asia and America. Species of Prunus exhibit a diversity of vegetative and reproductive morphologies, some of which (e.g., inflorescence type) have been emphasized in previous classifications, while others (e.g., position and morphology of the glands on the leaves) have received surprisingly little attention. Earlier workers divided the genus into five or six subgenera and seven to nine sections that are still recognized today. However, recent DNA sequence-based studies, all of which were based on fewer than about 25% of the species in the genus, have suggested that many infrageneric taxa are not monophyletic. Moreover, none of the aforementioned studies has included adequate representation of Pygeum, a group of about 40 species of the Old World tropics, formerly treated as a separate genus. These recent molecular phylogenetic analyses have elucidated various aspects of *Prunus* systematics, but many questions about the status of infrageneric taxa, character evolution, and historical biogeography across the genus remain unresolved. We have generated trnS-trnG-trnG, psbA-trnH, trnL-trnL-trnF, and matK sequences from more than 250 accessions of over 135 species and we present the most thoroughly sampled chloroplast DNA phylogeny of Prunus and discuss character evolution across the genus.

O2.11 AMANDA SAVILLE¹, ALEXANDER KRINGS¹, ROSE GRINNAN¹, AND WADE WALL¹. North Carolina State University¹. <u>Delimiting species boundaries in the Dichanthelium dichotomum complex</u> (Poaceae).

Dichanthelium dichotomum (L.) Gould (Poaceae) is a complex of diploid grasses, all found within the eastern United States. This widely encountered species complex is an important component of the eastern North American flora, but our current understanding of it is chaotic at best. The objectives of this study are: (1) to analyze taxonomic limits in the D.

dichotomum complex, using data from multivariate analyses of morphology, and (2) to test the fit of taxonomic circumscriptions of four major taxonomic treatments of the complex. In a continuation of previous work, morphological data comprised of 12 quantitative and 25 qualititative characters have been captured from 549 herbarium specimens, including 28 of 49 types, spanning the complex's range. Results from multiple analyses, including cluster and principal coordinate analyses (PCoA), show three mostly distinct groups referable to *Dichanthelium annulum* (Ashe) LeBlond, *D. yadkinense* (Ashe) Mohlenbrock, and a third including all other OTUs sampled. These groups were best circumscribed in treatments by Hitchcock and Chase (1910) and LeBlond (2001). Structure was evident in the clustering of remaining OTUs, although these exhibited varied overlap. Preliminary analyses of quantitative characters against geographic location show little evidence of a morphological cline within the group. Additional analyses, including ecological niche modeling and further examinations of character patterns within groups are planned.

O2.12 DAVID C. INGERSOLL¹ AND TIMOTHY MOTLEY¹. Old Dominion University¹, Dept of Biology, Norfolk VA 23529. <u>Establishing a Regional Phenology Network in Southeastern Virginia.</u>

Phenology is the study of recurring plant and animal life cycle stages. In plants, phenophases include flowering, fruiting, leaf emergence and senescence. Phenological data helps us understand the timing and fluctuations of seasonal cycles using biological components of the environment. The objective of this project was to establish a Southeastern Virginia Regional Phenology Network (SEVA-RPN) in support of the USA National Phenology Network (USA-NPN), which manages an open database contributed by numerous regional networks. The newly established SEVA-RPN collects data on a variety of plant species at two sites, Norfolk Botanical Garden and Blackwater Ecological Preserve. A website has been developed for the SEVA-RPN and contains information on sites and plant species as well as general information for the regional and national networks in order to enable standardized data to be compiled whether entered by amateur volunteers or professionals. At Norfolk Botanical Garden, with the assistance of volunteers and plant societies, phenological data is collected for several plant species in a garden environment including Camellia sinensis. At Blackwater Ecological Preserve, phenological data is collected for plant species in a natural environment including longleaf pine (Pinus palustris) and several blueberry (Vaccinium) species. Phenological cycles influence agriculture, horticulture, recreation, conservation and health and long-term data helps quantify and identify changes and trends associated with climate change. We hope to expand the SEVA-RPN in the future to collect data on additional species at additional sites and to investigate the phenology of blueberries (Vaccinium sp.) at Blackwater Ecological Preserve.

O2.13 IAN M. COHEN AND JOEY SHAW. The University of Tennessee at Chattanooga. DNA Barcoding: <u>Testing the Utility of One Coding and Three Noncoding Chloroplast DNA</u>

Regions using *Prunus* (Rosaceae) as a model. DNA Barcoding is the use of short DNA sequences (~700bp) to positively identify taxa to the species level. The goal is to make biodiversity inventories easier and more efficient since researchers would only need a small tissue sample rather than a suite of morphological characters, which may or may not be present at the time of collection. In animals, the mitochondrial gene cytochrome oxidase I is widely used for barcoding projects, and for all intents and purposes the zoological community is no longer actively looking for a barcoding region. Botanists, on the other hand, have had a much harder time identifying a particular gene region for plants. Recently, the Consortium for the Barcoding of Life's Plant Working Group proposed the use of two coding regions from the chloroplast genome (cpDNA), *matK* and *rbcL*, to serve as the universal barcodes for plants, but this decision did not come lightly

as several members advocated adding a noncoding cpDNA region (*psbA-trnH*) to the protocol. Our study uses the genus *Prunus* to assess the efficacy of one coding (*matK*) and three noncoding (*trnS-trnG-trnG*, *trnL-trnF*. and *psbA-trnH*) chloroplast regions. *Prunus* is a large genus of > 200 species found primarily in the northern hemisphere. For a barcoding study *Prunus* is an ideal model taxon since it contains both closely related species (e.g., the North American plum species), distantly related species (e.g., *Pygeum africanum* and *Maddenia hypoleuca* which were both considered separate genera, but have since been shown to be nested within *Prunus*), and wide-ranging species with numerous varieties (e.g., *P. serotina*, *P. avium*). We tested the utility of the above cpDNA regions on 256 accessions representing 128 species or lesser taxa to assess how well these regions perform as DNA barcodes alone or in combination. Initial results suggest that no region alone or in combination is robust enough to correctly identify the various taxa in our dataset due to issues related to interspecific and intraspecific variation.

O3.1 JOAN WALKER, BRYAN MUDDER, AND SHAWNA REID. Southern Research Station, US Forest Service. <u>Prescribed fire effects on Hexastylis naniflora, a threatened forest perennial.</u>

Hexastylis naniflora occurs in deciduous or deciduous-conifer forests in the piedmont of South Carolina and adjacent North Carolina. In Cowpens National Battlefield (COWP) it occupies lower slopes next to small streams, stream floodplains, and streambanks overhanging incised channels. Although the historical fire regime of Hexastylis habitats is uncertain, managers proposed burning for fuel reduction. In this study we addressed two questions: What is the effect of burning on Hexastylis abundance? Does burning change growth and flowering? We installed a field experiment with unburned and burned treatments replicated in 5 blocks. Pre-treatment data were collected in 2006 and 2007; four blocks were burned on February 20 and one on April 24, 2008; and data were collected in 2008 and 2009. Fires consumed surface litter but removed less than 5% of the duff. We used repeated measures ANOVAs to test for year and treatment effects. We found no significant effects of either year or treatment on plant abundance, size, or flowering, except in the April-burned block where no flowers were found. Both burned and control plots varied year to year, and monitoring is needed to understand baseline populations. Late winter fires that do not remove the duff layer are unlikely to change Hexastylis naniflora numbers, size, or flowering. The loss of flowers in an April fire raises questions about potential fire season effects on population processes.

O3.2 JONATHAN ADAMS, ROBERT CARTER, CHRIS MURDOCK, AND BENJIE BLAIR. Department of Biology, Jacksonville State University. <u>Effects of prescribed burning regimes on small mammal populations and Borrelia lonestari incidence on the Talladega National Forest, AL.</u>

A study of the relationship between prescribed burning and small mammal populations was conducted in the Talladega National Forest in east-central Alabama for 12 months following burn treatments. The study area consisted of twelve sites with burn treatments of 1 year, 2 year, 5 year and 15+ year control sites. A total of 66 individuals and 5 species were captured over 2160 trap nights. *Peromyscus leucopus* was the most common species captured with 48 captures and was captured in all treatment types. There was a significant difference in *Peromyscus leucopus* populations when comparing: the 15 vs. 5 year treatments, 15 vs. 2 year treatments, and 15 vs. 1 year treatments. Combined species density was highest in plots that were burned within the previous year (6.11 individuals/100 trap nights). Species density was lowest in plots that were burned 15 years ago (0.56 individuals/100 trap nights). Analysis of mammal tissue for the presence of *Borrelia lonestari* using DNA and polymerase chain reaction (PCR) showed no evidence of infection.

O3.3 ERIC S. MENGES AND STACY A. SMITH. Archbold Biological Station. <u>Fire and hurricane effects on annual survival of 14 co-occurring Florida scrub plants:</u> patterns from two decades of demographic research.

I analyzed the effects of fires and the 2004 hurricanes on annual non-seedling survival of 14 perennial Florida scrub plants based on data collected as early as 1988; from 7-20 years by species. Seven species always had > 80% annual survival; these species all resprouted post-fire. Seven species had widely varying survival, in many years < 60%; these species did not resprout post-fire. Most species had higher survival in the years following fire (some dramatically so) although the length of time that survival was enhanced varied among species. Fire interacted with year effects and weather variability to affect annual survival. Survival of all species was similar in hurricane and non-hurricane years. Two shrub species were damaged by falling debris or wind but only one species' growth was temporarily depressed. Hurricane effects were minimal in open habitats that had been maintained by periodic fire. In these interior Florida sites, fire is the predominant ecological disturbance. Most species show demographic responses that would tend to increase population sizes in areas that are periodically burned, but these species display a diversity of specific post-fire survival patterns.

O3.4 JOHN A. BARONE, LEQUITA W. ADAMS, A. CARMEN COAN, MICHAEL J. JOINER, COURTNEY N. RAYFORD AND KEVIN S. BURGESS. Columbus State University. <u>Influence of individual, local and regional factors on treehole abundance</u>.

The development of treeholes through decomposition could be influenced by factors operating at the individual, local, and regional levels. We examined the effect of two individual-level factors, species identity and stem size, and one local-level factor, stem density, on the proportion of trees with treeholes in a 1 ha vegetation plot in a midsuccessional forest in western Georgia. The vegetation plot included all trees and shrubs with stems ≥1 cm dbh, and all treeholes with an entrance diameter of at least 1 cm. Using data from this study and the literature, we also evaluated the effect of three regional-level factors, latitude, mean annual rainfall, and mean annual temperature, on treehole abundance. At the individual level, species were found to vary significantly in their susceptibility to treeholes, though stem size was not important. At the local level, the proportion of trees with treeholes was positively correlated with stem density across species. At the regional level, there was only weak evidence that latitude, annual precipitation and annual temperature were related to treehole abundance, but the paucity of tropical studies makes the results of this analysis difficult to assess. Overall, species identity seems the most important factor determining the susceptibility of trees to treeholes.

O3.5 DAMIEN WILLIS, ROBERT CARTER, CHRIS MURDOCK, AND BENJIE BLAIR. Department of Biology, Jacksonville State University. <u>Effects of prescribed burning regimes on tick populations and Borrelia Ionestari incidence on the Talladega National Forest, AL.</u>

Populations of the vectors (*Ambylomma americanum and Ixodes scapularis*) of tick-borne diseases can be influenced by anthropogenic disturbances in forested areas. A study of the relationship between prescribed burning and tick populations and *Borrelia Ionestari* incidence was conducted in the Talladega National Forest in east-central Alabama for 12 months following burn treatments. The study area consisted of twelve sites with burn treatments of 1 year, 2 year, 5 year and 15+ year control sites. Ticks were collected using the drag sampling method. The results indicate a significant drop in tick populations after a burn with a rapid recovery. Analysis of ticks for the presence of *Borrelia Ionestari* using

DNA and polymerase chain reaction (PCR) indicated the disease was present in the study area.

O3.6 MATHEW MORGAN, RUSTY NALL, AND ROBERT CARTER. Department of Biology, Jacksonville State University. <u>Using fecal counts to determine white-tailed deer (Odocoileus virginianus)</u> populations in four burning regimes on the Talladega National Forest, AL.

Populations of the white-tailed deer (*Odocoileus virginianus*) can be influenced by anthropogenic disturbances in forested areas. A study of the relationship between prescribed burning and deer populations was conducted in the Talladega National Forest in east-central Alabama following burn treatments. The study area consisted of twelve sites with burn treatments of 1 year, 2 year, 5 year and 15+ year control sites. Populations were determined by monthly fecal counts beginning in December of 2009.

O3.7 KERI TEAL AND JAMES FRALISH. Southern Illinois University, Carbondale, IL. Species convergence in three fire dependent communities of north central Wisconsin.

Prior to 1927, when strict fire control laws were passed, northern Wisconsin forests had been severely cut and burned producing a number of successional community types. Curtis and his students studied these community types in the mid 1940's. Beginning in 2001, successional patterns were examined in forest communities dominated by Pinus banksiana, Quercus ellipsoidalis, and Pinus resinosa. For each community type 15 stands were sampled using nested plots: 0.4 ha for trees, 0.002 ha for seedlings, and 0.004 for saplings. Tree diameter was converted to basal area and importance values (relative basal area) developed for each species. Sapling and seedling counts were converted to a per hectare basis and an importance value (relative density) developed for each species. Comparisons are being made between the overstory composed of shade-intolerant species and the understory of more shade-tolerant species using index of similarity and strata analysis to determine successional status. Understory composition between the three community types also is being compared. Preliminary analysis indicates that understories of most stands are composed of Pinus strobus, Quercus rubra, and Acer rubrum, suggesting convergent succession leading to an ultimate loss of biodiversity in the northern hardwood forest.

O3.8. CARI LELAND¹, TOM SALADYGA², AMY HESSL², PETER BROWN³, BAATARBILEG NACHIN⁴, BYAMBAGEREL SURAN⁵ AND NEIL PEDERSON¹. Eastern Kentucky University¹, West Virginia University², Rocky Mountain Tree Ring Research³, National University of Mongolia⁴, Colorado State University⁵. Climate and fire interactions in *Pinus sylvestris* forests of northern Mongolia.

Climate change is expected to be most pronounced and occur earliest in high, northern latitudes and in semi-arid to arid regions. Increasing temperatures and altered hydroclimatic regimes may influence the frequency, intensity, and extent of forest disturbance, particularly fire, in Mongolia. The impacts of climate change on ecosystems are especially important in Mongolia due to its pastoralist society, which relies on natural resources as a major source of economic livelihood. Tree-rings are a valuable tool for assessing forest dynamics through time, and can be used to determine potential relationships between climate and fire over a multi-centennial time scale. Extensive *Pinus sylvestris* (Scots Pine) forests in Mongolia can provide long (i.e. ≥250 years) records of climate and fire in regions where fire exclusion has not been practiced. Here we present three *P. sylvestris* drought-sensitive chronologies from sites that were recently sampled in northern Mongolia. Preliminary analyses of the chronologies suggest that the new region

is climatically different from other, previously-sampled nearby regions. Secondly, we present an analysis of climate and fire interactions in one drought-sensitive forest (Tujiyn) in northern Mongolia to determine if potential changes in moisture through time have influenced a localized fire regime. Further research will be necessary to investigate climate and fire relationships at broader scales. A network of tree-ring and fire scar records from multiple sites is required to determine if recent climate change has resulted in regionally-synchronous changes in forest structure and disturbance.

O3.9 CHASE C. ROSENBERG, BRIAN C. MCCARTHY, AND JARED L. DEFOREST, Department of Environmental and Plant Biology, Ohio University. <u>Potential effects of the decomposition of hybrid chestnut on nutrient cycling in Eastern North American forests.</u>

The American chestnut, Castanea dentata, was dominant in hardwood forests in eastern North America, having accounted for 40-45% of the mature trees in Southern Appalachia. The Asian root-borne pathogen Cryphonectria parasitica was introduced in 1904, killing the majority of mature chestnuts. Recent work has produced a new, pathogen-resistant hybrid variety. The possibility exists of large-scale reintroduction to eastern American forests, but preliminary information on the composition of the chestnut hybrid and the potential effects on the forests it would inhabit is needed. We predicted that due to greater concentrations of precipitate tannin in C. dentata, its litter would decompose at a slower rate and contain more recalcitrant organic compounds when compared to co-occurring species. We also predicted that there would not be significant differences in the chemistry and decomposition profiles of hybrid chestnut and pure American chestnut. In Autumn 2008, litter bags were placed in a mesic beech / oak forest in Southeast Ohio. The bags contained either C. dentata, C. mollissima, hybrid chestnut, Quercus alba, or Acer rubrum. Bags were collected at three month intervals for one year, and mass loss was calculated. Leaf extracts were tested for tannins, C:N ratio, and nutrient concentrations. A carbon fractionation was conducted to evaluate the relative availability of litter fractions for decomposition. Chestnut taxa showed more rapid loss of mass and tannins, and lower concentrations or lignin than co-occurring species. These data imply that a reintroduction of hybrid chestnut would not lead to increased humification or an alteration in nutrient cycling regimes.

O3.10 PHOEBE WRIGHT, MELISSA CREGGER, NATHAN J. SANDERS, and AIMEE T. CLASSEN. University of Tennessee. <u>Interactions among insect herbivory</u>, invasive plants, and soil nutrients alters soil microbial function.

Ecosystem processes can be shaped by top down (e.g., herbivory) and bottom up (e.g., nutrient availability) controls. While we know interactions between nutrient availability and herbivory influence ecosystem processes we do not have a good understanding of how soil microbial communities may respond to these interactions. We took advantage of a long-term (5 year) experiment to test how herbivory, nutrient availability, and propagule pressure of an invasive species interact to shape the activity and diversity of soil microbial communities. Our study resulted in two main effects: 1) Phosphatase, an enzyme involved in acquisition of phosphorus, was 44% higher in plots where carbon was added relative to plots with no carbon added. 2) Beta-glucosidase activity, which assays for carbon degradation, was 19% higher in plots with insects relative to plots where insects were removed, and 26 % higher in the carbon addition plots. Beta-glucosidase also responded to the interactive effect of insects and nutrients; the plots with insects and carbon added having 56% more Beta-glucosidase. Together these results indicate that there are both bottom up and top down influences on soil microbial community activity.

O3.11 RACHEL E. SCHROEDER¹, FRANK P. DAY¹, DANIEL B. STOVER², ALISHA L. P. BROWN¹, JOHN R. BUTNOR³, C. ROSS HINKLE⁴, AND BERT G. DRAKE⁵. Old Dominion University¹, Earthwatch Institute², U.S. Forest Service³, University of Central Florida⁴, Smithsonian Environmental Research Center⁵. Root biomass in a Florida scrub-oak ecosystem after 11 years of CO₂ enrichment.

A scrub-oak ecosystem at Kennedy Space Center on Merritt Island on the east coast of Florida was exposed to 11 years of elevated atmospheric CO_2 (1996-2007). We hypothesized that vegetation exposed to elevated CO_2 would have greater root biomass than that receiving ambient air. Fine root biomass was estimated from mass/root length values applied to minirhizotron-collected root length data. Coarse root (> 5 mm diameter) biomass was estimated by ground-penetrating radar (GPR) imaging. Total root biomass to a depth of 60 cm after 11 years of CO_2 enrichment was 7252 ± 511 g m⁻² for the elevated and 6067 ± 403 g m⁻² for the ambient CO_2 plots. Coarse roots comprised 80% of the total root biomass for elevated and 84% for ambient CO_2 plots. Root-to-shoot ratios were 3.3 for elevated and 4.6 for ambient plots, showing that root biomass was greater than aboveground biomass in this system. Substantial carbon sequestration from the atmosphere occurs in belowground plant structures in this system, providing an important sink for increasing atmospheric CO_2 . Assuming carbon makes up roughly 50% of root dry mass, plots under elevated CO_2 sequestered 5.93 Mg/ha more carbon than plots under ambient CO_2 .

O3.12 MELISSA A. CREGGER¹, NATE G. MCDOWELL², WILLIAM T. POCKMAN³, and AIMEE T. CLASSEN¹. University of Tennessee¹, Los Alamos National Laboratory², and University of New Mexico³. <u>Drought changes nitrogen</u> availability in a pinyon-juniper woodland.

Climatic change is causing both the frequency and the severity of droughts to increase in the southwestern US. These changes are altering ecosystems directly, by decreasing available water, and indirectly by causing long-term shifts in species distributions where species that are more drought resistant persist. This pattern is particularly striking in pinyon-juniper woodlands where increases in drought frequency has resulted in a loss of pinyon pines (Pinus edulus)-resulting in a juniper (Juniperus monsperma) dominated landscape. To understand how changes in precipitation are altering pinyon-juniper woodlands, we measured soil nitrogen mineralization and soil nitrogen availability beneath both pinyons and junipers in an existing, large scale, precipitation manipulation (50% reduction drought treatment, 50% increased precipitation treatment, a water removal and reapplication control, and an unmanipulated control) in central New Mexico. We found that nitrogen cycling in this woodland was more sensitive to plant identity than to direct changes in precipitation. There was 29% more nitrogen available beneath pinyon relative to juniper (F = 4.4, p = 0.04). In addition, on average, ammonium was immobilized beneath juniper but mineralized beneath pinyon trees (F = 8.1, p = 0.006). These data suggest that as pinyon die across the landscape, alterations in the nitrogen cycle may result in a decrease in available, mobile nitrogen in an already nutrient limited ecosystem.

O3.13 LAUREN BREZA, LARA SOUZA, NATHAN J. SANDERS, AND AIMEE T. CLASSEN. University of Tennessee. <u>Intra-specific variation in ecosystem function within a dominant old-field species</u>.

Solidago altissima is a common old-field plant Intra-specific variation in ecosystem function within a dominant old-field speciesspecies whose genetic identity influences associated communities as well as ecosystem processes. In 2009, we established a common garden experiment by creating monoculture populations of 35 Solidago genotypes originating from either Tennessee (TN) or Connecticut (CT). Using the established populations we asked two questions: (1) Does intra-specific variation in

Solidago productivity alter net ecosystem carbon gain? and (2) Does intra-specific variation in productivity across *Solidago* alter ecosystem carbon loss? We quantified monoculture productivity using allometric equations and ecosystem carbon gain and carbon loss using a net ecosystem exchange chambered equip with an infra-red gas analyzer. Our experiment resulted in three main findings: 1) TN populations produced 13×10^{15} more aboveground biomass than CT populations (P < 0.0001), 2) Ecosystem carbon gain was 2×10^{15} greater in TN relative to CT (P < 0.0001) populations, but total ecosystem carbon loss did not differ among genotypes (P > 0.05), There was no intra-specific variation in aboveground biomass or ecosystem carbon exchange within TN and CT populations. In conclusion, we found that productivity and net ecosystem exchange in *Solidago* differ across, but not within, populations. Our results highlight the important role intra-specific variation can play in shaping ecosystem function.

O4.1 Canceled

O4.2 RYAN J. SEDDON AND MATTHEW KLUKOWSKI, Middle Tennessee State University. The effects of acute stress on corticosterone, leukocytes, and prostaglandin E₂ in male Southeastern Five-lined Skinks (*Plestiodon inexpectatus*).

Increased glucocorticoid levels are an important component of the stress response. Glucocorticoids induce physiological and behavioral changes by binding to three different types of receptors. The main glucocorticoid in reptiles is corticosterone. While immunosuppressive effects of chronically elevated corticosterone are well known, acutely elevated corticosterone levels may actually enhance immunity. For example, transient increases in corticosterone enhance macrophage migration inhibition factor, upregulate cytokine receptors on T-cells, and alter prostaglandin levels. Prostaglandin E2 is a downstream mediator of fever and systemic inflammation. Acute stress is also reported to increase the heterophil:lymphocyte ratio in the blood. Some evidence supports the idea that heterophils and eosinophils are the same in some lizards. Here we tested whether acutely stressed lizards had elevated prostaglandin E2 levels and increased eosinophil:lymphocyte ratios. Twenty-four male Plestiodon inexpectatus were captured with half being bled immediately and half after one hour of confinement. Plasma corticosterone levels and eosinophil:lymphocyte ratios were significantly higher in the confined group. While PGE₂ levels did not differ significantly, they were significantly positively correlated with corticosterone levels. The change in eosinophil:lymphocyte ratio could be used to prepare the immune system for potential effects of stressors, such as injury. Similarly the apparent elevation of PGE₂ in confined males, as well as the positive correlation between PGE2 and corticosterone, suggests a role for PGE2 in orchestrating the immune response to stress in male skinks.

O4.3 CAROLINE WALLACE AND VICTORIA TURGEON. Furman University. <u>The Role of Cx32 in Schwann Cell Myelination.</u>

Neurons in the peripheral nervous system require myelination by Schwann cells for normal rates of signal transduction. When myelin does not form properly neurological diseases can arise, such as Charcot-Marie-Tooth (CMT) disease. Past studies have shown that proteins such as PLP and MBP are vital for holding the myelin sheath to a neuron's axon. However, in the case of CMT-like diseases, mutations in the gap junction protein, Connexin 32 (Cx32), appear to cause the myelin to not wrap completely around the axon. We hypothesize that Cx32 is essential for proper myelination. Blockage of Cx32 with 2-APB, a known inhibitor of Cx32 resulted in significantly decreased proliferation of Schwann cells when cultured with 100 μ M 2-ABP for 24 (p =0.0042) and 48 hours (p=0.0300), suggesting that the decrease in myelination could be due to a decrease in Schwann cell proliferation. However, it is also possible that blockage of Cx32 interferes

with the production of the major myelin proteins whose levels are being determined by Western blot analysis. Understanding the specific role of Cx32 in myelination of the peripheral nervous system may lead to future treatment for demyelinating diseases such as CMT.

O4.4 PERRIE HORD AND XUEYA HAUGE. Kennesaw State University. <u>Identification</u> and characterization of cis-regulatory elements in a deletion junction region for <u>9p-syndrome</u>.

The chromosomal disorder, 9p- syndrome, is caused by terminal deletions of the short arm of human chromosome 9 and results in severe mental retardation, dysmorphic facial features, and trigonocephaly. The deletion of cerberus 1 (CER1) gene located 14.7 Mb from the 9p terminus has been suggested as the cause of trigonocephaly. However, 2 recent independent reports showed that patients whose phenotype is consistent with 9psyndrome possess smaller than 12.4 Mb deletions, leaving 2 intact copies of the CER1 gene in these patients. It raises the possibility that cis-regulatory elements for CER1 gene could be located in the first 12.4 Mb of 9p. Previously, we identified ~270 highly conserved non-coding sequences (CNSs) between 10 and 12.4 Mb from 9p terminus. In this study, we selected 5 CNSs located at the deletion junction region (at 12.4 Mb), and tested their potential regulatory functions using a dual-luciferase reporter assay. Sequences of interest were cloned into the 5' of the luciferase gene which is controlled by a minimal promoter. A co-transfection of the CNSs-luciferase gene construct and an internal control vector carrying the renilla gene was performed in HEK293T cells. Once the transfected cells were lysed, substrates for both luciferase and renilla were added sequentially to the lysate, and a ratio of luciferase to renilla light units was obtained using a luminometer. Of the 4 CNSs-luciferase constructs tested, one significantly increased the luciferase production, acting as an enhancer, while another dramatically suppressed the luciferase production, acting as a silencer.

O4.5 JUSTIN RHEUBERT AND DAVID SEVER. Southeastern Louisiana University. Morphology of the extra-testicular ducts in the Mediterranean Gecko, Hemidactylus turcicus.

The reproductive system of the Mediterranean Gecko, Hemidactylus turcicus, was investigated using light and electron microscopy to determine the gross and ultrastructural morphology of the extratesticular ducts. The seminiferous tubule/s converge/s into a single rete testis tubule that is lined with a squamous to low cuboidal epithelium. The epithelium contains both cilia and microvilli with a labyrthine network of intercellular canaliculi. This network of canaliculi contains vacuolated material, sparse leukocytes, and multiple desmosomes apically. The lack of basal junctions between adjacent plasma membranes suggests absorption of interstitial fluids by the rete testis. However, the presence of multiple coated vesicles, Golgi bodies, and rough endoplasmic reticulum may also suggest secretory activity. The rete testis divides into 3-4 tubules, the ductuli efferentes, that are lined with a columnar epithelium that is highly ciliated. The intercellular canaliculi networks are less extensive than in the rete testis. The cells of the ductuli efferentes are packed with mitochondria, secondary lysosomes, and endoplasmic reticula. The ductuli efferentes appear to each divide once before entering the perpendicular epididymis. The epididymis is highly coiled grossly and microscopically is lined by a pseudostratified epithelium with principal cells and basal cells, although basal cells are rarely observed. The epididymis also contains complex networks of intercellular canaliculi. The epithelium contains multiple microvilli, apical tight junctions, large secretory granules, and endoplasmic reticulum. No basal cells or regional differences were observed ultrastructurally. These data may provide insights into the functions and evolution of the vertebrate excurrent duct system.

O4.6 Canceled

O4.7 WILLIAM WATKINS¹, KEVIN BRINCK², PAUL BANKO³, WILLIAM BROOKS, MARTIN CIPOLLINI¹, AND REBECCA NEAL¹. Berry College¹, Hawaii Cooperative Studies Unit, Pacific Aquaculture and Coastal Resources Center, University of Hawaii at Hilo², and U. S. Geological Survey, Pacific Island Ecosystems Research Center³ Intraspecific developmental variation in quinolizidine alkaloids of mamane (Sophora chrysophylla) seed embryos: relevance to specialist seed predation by palila (Loxioides bailleui)

The endangered palila bird (Loxioides bailleui), the last finch-billed member of the Hawaiian honeycreepers remaining in the main Hawaiian Islands, relies on the embryos of the seeds of mamane (Sophora chrysophylla) as the main constituent of its diet, especially during breeding season. While the embryos are rich in lipids, proteins, and minerals, they also contain levels of quinolizidine alkaloids (QAs) toxic to most organisms. Although no mechanism for QA metabolism is known, palila do not exhibit obvious pathology from alkaloid ingestion. Field observations suggest that palila may select for mamane trees with low levels of QAs, effectively avoiding QA toxicity. Embryo samples were taken from +/-40 trees across four fruiting seasons and tested for variation among sixteen common QA's using GLC in 2006. QA analysis showed high levels of within- and between-tree variation. In an effort to control for various sources of variation, embryos were collected monthly from a single group of pods at the same developmental stage on nine trees over a period of four months. GLC analysis focused on delineating any consistent temporal patterns in QA constituency. Initial data suggests that alkaloid levels tend to decline for three months only to sharply rise in the final month of development. This pattern cannot be related to environmental conditions, but examination of rainfall records may offer an important correlation. By understanding whether palila selectively forage based on alkaloid levels, resource managers might better understand the importance of mamane forest restoration in respect to the continued survival of the palila.

O4.8 WEI REN¹ AND STEPHEN J. BEEBE^{1, 2}. Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk Virginia¹, Department of Physiological Sciences, Eastern Virginia Medical School, Norfolk Virginia².

Nanosecond Pulsed Electric Fields (nsPEFs) Activate Multiple Apoptosis Pathways in E4 Squamous Carcinoma cells *In Vitro*.

We explored apoptosis signaling pathways involved in nsPEF-induced cytotoxicity in E4 squamous carcinoma cells by exposing them to multiple pulses from 0 to 60kV/cm with 300ns durations. NsPEFs triggered cell demise correlated with pan caspase activation within the first hour in an electric field-dependent manner. Cell death occurred with decreases in mitochondrial membrane potential ($\Delta\Psi$ m), cytochrome c release, phosphatidylserine externalization, decreases in Bid and increases in t-Bid. At earlier times and at lower electric fields, active caspases appeared in the absence of cytochrome c release, suggesting a mitochondria-independent extrinsic pathway. However, at higher electric fields, cytochrome c release was concomitant with activation of caspases. Complete inhibition of caspase activity with z-VAD-fmk partially attenuated cytochrome c release, indicating a mitochondria-dependent extrinsic apoptosis pathway. Calcium chelation partially inhibited Bid cleavage, suggesting calcium-dependent and -independent mitochondria-mediated mechanism(s). Taken together, these findings suggest that nsPEFs induce apoptosis-like cell death using mitochondria-dependent and -independent mechanisms.

O4.9 INDRANI DEY, PRANJAL NAHAR, TREY SLANEY, AND CHRISTI MAGRATH. Troy University. <u>Transcription termination activity of ARS elements in Saccharomyces cerevisiae</u>.

Autonomous replicating sequences (ARS) are required for replication origin function and have molecular similarities with transcription terminators in *S. cerevisiae*. Using Chromosome III as a model chromosome, the transcription termination capacities of 19-20 ARS elements are being assessed. After updating the sequence information available for the ARS elements, PCR has been used to successfully amplify the ARS elements. The results of the ongoing analysis demonstrate that these fragments can be inserted into a previously described transcription termination reporter construct and introduced into wild type yeast. Completion of construction of this set of molecular reporters will allow qualitative and quantitative assessment of modulation in transcription termination activity for each ARS element. Correlating the strength of replication origin activity with level of transcription termination and completing the first chromosome-level analysis of ARSs transcription termination capacity will assist in establishing the relationships between the molecular processes of replication initiation and transcription termination in *S. cerevisiae*.

O4.10 KAREN R. HASTY, MALLORY L. WEST, AND DAVID R. WESSNER. Davidson College. <u>Disassembly of ethanol-resistant reovirus strains and associated effects</u> on virus-induced apoptosis.

To successfully replicate, mammalian viruses must enter a host cell and undergo a disassembly process to expose the viral genetic material to the host cell's replication machinery. Reovirus, a non-enveloped virus composed of both an outer capsid and inner core, undergoes this process in two steps. Initially, the outer capsid is partially removed, resulting in the formation of an ISVP (Infectious Sub-Viral Particle). Subsequently, the remaining outer capsid proteins are removed completely, resulting in a transcriptionally active core particle. In a previous study, mutant strains of reovirus were isolated that exhibit increased resistance to ethanol. Additional studies have shown that these mutant reovirus strains exhibit decreased neurovirulence in mice (unpublished data). In these studies, we show that these mutant viruses form ISVPs normally, but do not form core particles under standard assay conditions in vitro. We hypothesize that the disassembly defect exhibited by these viruses may result in their attenuated neurovirulence. Furthermore, this attenuation could be the result of a diminished ability of these viruses to evoke apoptosis in infected cells. To explore this possibility, we currently are investigating the ability of these mutant viruses to cause apoptosis in mouse L929 cell lines. We are indirectly quantifying apoptosis using real-time PCR to compare the amount of proapoptotic mRNA in cells mock infected or infected with different strains of reovirus. If a difference between wildtype and mutant strains is discovered, then the further characterization of these ethanol-resistant viruses could provide insight into pharmacological strategies to prevent viral diseases exacerbated by apoptosis.

O4.11 MALLORY L. WEST, KAREN R. HASTY, AND DAVID R. WESSNER. Davidson College. Replication properties of reovirus disassembly mutants.

Mammalian reoviruses are non-enveloped viruses with two icosahedral capsids. During viral replication, virions undergo a two-step disassembly process that involves the sequential removal of the outer capsid proteins. Virions first disassemble into infectious subviral particles (ISVPs) and then into transcriptionally active core particles. Previously, several mutant strains of reovirus were isolated that exhibit increased resistance to ethanol. We have shown that these mutants undergo altered capsid disassembly *in vitro*. Because the mutant strains exhibit altered capsid disassembly *in vitro*, we hypothesized that these mutants also would exhibit altered replication kinetics. To test this hypothesis, we have examined the replication of these viruses in cell culture. At both 37°C and at 32°C, wildtype and mutant strains of reovirus exhibit identical replication kinetics. We currently are examining the replication of these viruses in the presence of ammonium chloride to further characterize their replication properties. Additionally, we are

investigating the replication of these viruses in the presence of novel nucleoside analogues. Composed of a ribose group and a nucleobase, nucleoside analogues mimic natural nucleotides, but, because of their structure, serve as chain terminators. We hypothesize that the mutant strains of reovirus may be differentially sensitive to such compounds. To test this hypothesis, we first are investigating the cytotoxic effects of selected nucleoside analogues. We also are comparing the replication kinetics of wildtype and mutant viruses in the presence of these compounds. These results will allow us to further characterize the properties of these viral mutants.

O4.12 JAMES R. RAYBURN¹ AND MENDEL FRIEDMAN². Biology Department, Jacksonville State university¹, ARS-USDA Western Regional Research Center². N-acetyal-L Cysteine Protects Frog Embryos against Acrylamide-Induced Malformations and Mortality.

Previous studies with the Frog Embryo Teratogenicity Assay (FETAX) demonstrated that acrylamide, a compound present in processed plant-derived foods such as bread crust and potato fries, is a teratogen. Other studies showed that administration of acrylamide during organogenesis produced maternal and developmental toxicity in mice and maternal, but not developmental, toxicity in rats. The objective of the present study was to determine if N-acetyal-L-cysteine could be used to reduce acrylamide toxicity and teratogenicity. To accomplish this objective, we investigated the effect acrylamide alone and then the effects of N-acetyal-L-cysteine on mortality, malformation and embryo length induced by select concentrations of acrylamide. We determined that the experimental 96hr LC₅₀ (concentration that kills 50% of the embryos) of acrylamide alone was equal to ~0.0024 M. The corresponding value for EC₅₀ (concentration that induced terata in 50% of the embryos) equaled to ~0.008 M. The teratogenic index (TI) value equaled to ~3.0. These results confirm that acrylamide is strong frog embryo teratogen. We then selected conditions that induced 100% malformations and mortality to test the anti-teratogoenic potential of N-acetyal-L-cysteine. The data indicate that N-acetyal-L-cysteine protected the embryos against acrylamide induced malformations and mortality. These results suggest that N-acetyal-L-cysteine has the potential to protect fetuses of against acrylamideinduced malformation; and demonstrate the potential utility of FETAX for determining protective effects of other dietary ingredients against acrylamide toxicity.

O4.13 LI-JU CHEN, CHRISTOPHER MURDOCK, AND FRANK ROMANO. Jacksonville State University. <u>Intercontinental geographic variation in 18s rDNA within tardigrade individuals, species, and populations.</u>

To investigate the role of geographic separation on tardigrade phylogeny, at the individual and community levels, specimens from North America, Asia, Europe, and Antarctica were studied using phylogenetic analysis. Individual specimens were characterized using morphological features, followed by DNA extraction and amplification of a region of 18S rDNA; additional sequence data from individual tardigrades was obtained from the National Center for Biotechnology Information (NCBI). Milnesium tardigradum individuals collected from Taiwan (Asia) showed higher gene diversity over loci (0.0158), relative to samples from North America (0.0023). Interestingly, some samples from Taiwan had more sequence homology to individuals from North America than to others from Taiwan. Occurrence of single nucleotide polymorphisms (SNP's) was centered along a 150 base pair region (position 100-250 in DNA alignment) in M. tardigradum samples. Additionally, statistical parsimony network analysis showed North American and European samples were separated by a common SNP; Taiwan samples were a mix. Morphologically, M. tardigradum is a group of species that has been recently separated (Tumanov et al. 2006). Thus, its seems that two or more distinct M. tardigradium sequences might originate from another species in the genus Milnesium that has yet to be characterized using 18S rDNA. Comparison of 18s rDNA sequences from Dactylobiotus ambiguus, from North America and Antarctica showed little variation, with a single SNP, located at base pair 147 in DNA alignment, that separated samples geographically.

O4.14 MIJITABA HAMISSOU. Jacksonville State University, Jacksonville, AL 36265-Comparative Analyses of Callose Biosynthesis in Sorghum bicolor (L.) Moench and Nicotiana tobacum Using Molecular and Microscopic Techniques

When plants are wounded, the removal of the protective epidermis leaves the mesophyll tissue exposed to desiccation and attack by bacteria and fungus. Plants must block the damaged sites as well as their plasmodesmata with polysaccharide cement known as callose. This helps prevent bacterial and fungal infection and the loss of cytoplasmic contents from wound sites. Callose is a β – 1, 3 glucan polymer of glucose, a major component of inducible plant cell wall apposition. In-vitro studies have shown that the detergent Triton X-100 is inhibits callose synthase activity in the plasma membrane of some plants. This research is reporting the result of molecular and microscopic investigations of callose biosynthesis in injured sorghum and tobacco plants. Adult plants grown in pots were subjected to mechanical injury by puncturing their leaves with needle and/or subjected to clipping with scissors. Callose biosynthesis was investigated biochemically in extracts of leaf tissues following differential centrifugation. In-situ investigations were performed microscopically by staining leaf tissue with 0.1% aniline blue. Preliminary results indicated that callose production in injured sorghum is higher than in injured tobacco plants and that treatment of the plants with triton X-100 following injury negatively affects callose production in both Sorghum and Tobacco plants.

O5.1 ANDREW LAUGHLIN¹ AND FRED J. ALSOP III¹. East Tennessee State University¹. Hermit Thrush (Catharus guttatus) and Veery (C. fuscescens) breeding habitat associations in Southern Appalachian Spruce-Fir forests.

The Hermit Thrush is a relatively recent breeding bird in the high-elevation forests of the Southern Appalachians, having expanded its range southward over the last four decades. Here it overlaps with the breeding territory of the Veery, a congeneric , well-established breeding resident. The aim of this study was twofold: 1) to compare breeding habitat associations between the two species, and 2) to gather information on the local breeding habitat preferences of the Hermit Thrush. Thirty-six topographic and habitat variables were measured in Hermit Thrush (n=30) and Veery (n=24) territories, ten of which showed significant differences between the species preferences. In general, Hermit Thrush territories had more leaf-litter ground cover, a more open understory, and higher basal area and canopy closure. Veery territories had a much thicker shrub layer and a less developed canopy. The Southern Appalachian Spruce-Fir forest is one of the most endangered forest types in North America, due to past logging, acid deposition, and aphid infestation. It is important to document bird-habitat relationships here to better understand how birds may be affected in the future.

O5.2 STEVEN R. HILL. Illinois Natural History Survey, University of Illinois, Champaign. Results of transplanting and re-establishment of Aster furcatus Burgess (Asteraceae) in Illinois.

A population of approximately 300 individuals of the perennial *Aster furcatus* Burgess, threatened in Illinois, was found to be in the direct path of a road construction project planned for 2005-2006. Instead of transplanting these to some other possibly less suitable site, it was decided to dig the plants, maintain them at a nursery, and plant them back at approximately the same location after construction had been completed, whereupon they would be monitored for three years to analyze their survival. A protected control colony was left in place adjacent to the construction site. This methodology was new for the highway personnel, and the results could be of conservation interest. Erosion, invasive

exotic and native weeds, animal predation, exposure, soil moisture, and weather all combined to either encourage or inhibit the plants based upon their positions in the transplanted colony. *Phragmites australis* and *Coronilla varia* were the greatest weed threats. Shade, soil moisture, and protection from animal browsing were the factors most important to the successful re-introduction of this species at the site. After three years, well over 1,000 stems were found to be present suggesting very significant survival during the monitoring period.

O5.3 DAKOTAH A. CAMPBELL AND CHRISTOPHER A. ADAMS. King College. <u>Seed dormancy and germination ecology of Robinia hispida and Calycanthus floridus var. glaucus.</u>

The seed germination ecology of Robinia hispida and Calycanthus floridus var. glaucus, a rare plant in Kentucky, was investigated. It was discovered that he seeds of both species are dormant at maturity. Fewer than 15% of seeds in both species germinated under suitable environmental conditions. Seeds from both species were exposed to a variety of treatments to determine the type of seed dormancy and method of breaking dormancy: cold stratification, mechanical scarification, heating on dry and wet media, wetting and drying, boiling, freezing and thawing, and acid scarification. In both species, it was determined that mechanical scarification increased the chance of germination dramatically. When compared to the control, it was determined that for R. hispida seeds, there was an increase in germination from 10% to approximately 90%. In C. floridus seeds, the increase was from 12% to approximately 80%. These data clearly demonstrate that mature seeds possess physical dormancy, and mechanical scarification is the most effective method to break this dormancy. It was also determined that both species possess low seedling survivorship following germination, with R. hispida at 47% survival and C. floridus at 35% after one month of exposure to late spring/early summer conditions. The presence of physical dormancy in seeds and low seedling survivorship are possible explanations for the low abundance of individuals throughout their respective ranges.

O5.4 CAITLIN M. GUSSENHOVEN AND H. DAWN WILKINS. University of Tennessee at Martin. Niche partitioning and overlap between wintering woodpeckers in a bottomland hardwood forest in northwest Tennessee.

The competitive exclusion principle states that two species cannot hold the exact same niche in the same area at the same time. Woodpeckers belong to the bark foraging guild, which exploit the vertical habitat on trees and are known for partitioning resources. The goal of this study was to describe the niche overlap and breadth of four commonly observed woodpeckers in a bottomland hardwood forest during the winter. Specifically, we were interested in interactions between two closely related species, Red-headed (Melanerpes erythrocephalus) and Red-bellied Woodpeckers (Melanerpes carolinus). Observations were taken every thirty seconds for fifteen minutes of woodpecker behavior and location. Downy Woodpeckers (Picoides pubescens) were observed foraging on small main branches and peripheral branches, possibly reducing overlap with larger species. Since Yellow-bellied Sapsuckers (Sphyrapicus varius) forage primarily on sap, they were specialized on living trees, minimizing overlap with other species. Niche overlap, for the characteristics measured, was the highest between Red-bellied and Red-headed Woodpeckers, with aggressive interactions observed between them. Red-bellied Woodpeckers were observed primarily on the trunk and main branches, likely engaged in foraging and pair bonding activities. Red-headed Woodpeckers were observed primarily on main branches and were often vigilant, possibly fly-catching or guarding acorn caches. Red-headed Woodpeckers are irruptive migrants whose presence may be related to annual mast production, which may lead to annual changes in niche relations between the two species.

O5.5 AMANDA R. ROTELLA AND JAMES O. LUKEN. Coastal Carolina University. The growth and distribution of water hyacinth in a tidal blackwater river system, SC

The purpose of this research was to examine the growth and distribution of water hyacinth (Eichhornia crassipes) in a blackwater river system (Waccamaw River, SC). In South Carolina water hyacinth is regarded as a nuisance due to its interference with navigation. However, few previous studies in South Carolina examined growth and distribution of water hyacinth in a tidal blackwater river. I compared populations of water hyacinth along a salinity gradient to determine how differing water quality affected growth. Three river zones were identified. Plants were deployed in cages made out of nylon netting and PVC and were anchored in the river zones. The cages were left for one month. Plants were then removed and growth was measured. Plant density and biomass allocation were determined through sequential harvest. A bucket experiment on salinity tolerance was also done. Mid and lower river sites had more growth and new production than the upper river site. The majority of growth occurs in leaves. Density is greater in the back of the mat during the fall season, than in the spring. The salinity experiment indicated that salt levels over 3 ppt resulted in inhibited growth. The research showed that standing crop and growth can be relatively high in this system, but as plants move down the river towards higher salinity levels, they will die off.

O5.6 JONATHAN L. HORTON¹ AND MATTHEW J. GERMINO². University of North Carolina at Asheville¹, Idaho State University². Response of native and exotic vegetation to supplemental surface and deep water in a sagebrush steppe.

Loss of foundation species in semi-arid steppelands promotes the invasion by Eurasian forbs by freeing up deeper soil resources that are then exploited by exotic species. Additionally, these invasives may be more plastic in their water use than natives. We investigated the ability of different plant functional types, a native grass (Stipa comata), native shrub (Artemisia tridentata) and invasive forb (Tragopogon dubious) to utilize simulated summer pulses of precipitation in 2007 and 2008. Additionally, in 2008 we isotopically labeled water at 75 – 100 cm depth to examine plasticity of water use. In 2007, all species took up applied surface water, accounting for 80% of xylem water in Stipa within 2 days after application. Peak surface water use in Tragopogon and Artemisia occurred 6 days after application and accounted for 80% of xylem water in Tragopogon and 55% in Artemisia. These patterns of surface water uptake were confirmed in 2008. Additionally, we found that Tragopogon took up labeled water from 75 cm depth when growing with Artemisia, which used water from a deeper source. In plots lacking Artemisia, both the Tragopogon and Stipa had similar patterns of water uptake. One characteristic that may help Tragopogon and other Eurasian forbs invade semi-arid regions in North America is plasticity of water use, being able to compete with native species for shallow resources and utilize deeper resources that become available after loss of deep rooted shrubs.

O5.7 ROBERT J. WARREN II^{1,2}, VOLKER BAHN² AND MARK A. BRADFORD¹ Yale University¹ Wright State University². Niche limitations of a vigorous exotic invader, Microstegium vimineum, across temperate forest ecotones.

Microstegium vimineum is a vigorous invasive grass that can overrun native vegetation in forest understories in the eastern US. Its abundance along roadsides and waterways has led to speculation that these are dispersal corridors for its propagules. We confirm this association, but also investigate how environmental variables within these habitats correspond with stage-specific M. vimineum demography. That is, instead of just potential dispersal corridors, the environmental conditions associated with roadsides and

waterways may create suitable habitat for *M. vimineum*. If forest edge and interior habitats are equally suitable, we expect weak demographic responses to the associated environmental drivers; otherwise, strong responses indicate disparity in habitat suitability. We also expect significantly increased reproduction within the higher sunlight edge habitats, while weak differences in reproductive output across forest ecotones falsify a source-sink dichotomy. Our results demonstrate that all habitats are not equally suitable for *M. vimineum* – even those within which it occurs. *Microstegium vimineum* occurs most in edge habitats, particularly roadsides, and near waterways. The environmental drivers associated with these habitats are strongly linked with *M. vimineum* demographic performance as plant establishment increases with soil moisture and temperature, but is hindered by leaf litter; growth increases with diffuse light and soil moisture; and reproductive output only responds to increased light. *Microstegium vimineum* is considered a threat to understory forest habitats in the eastern US, and our results suggest that successful understory invasion requires mesic conditions, proximal edge habitats and litter disturbance for seed establishment.

O5.8 MARY C. MILLS¹, GARY N. ERVIN¹, BRIAN S. BALDWIN¹, RACHEL C. JOLLEY¹ AND DIANA M. NEAL¹, Mississippi State University. Response of rivercane (*Arundinaria gigantea*) to native and exotic grass competition and site preparation techniques for canebrake restoration.

Canebrakes are dense stands of Arundinaria gigantea (Walt.) Muhl. that were once prominent in the southeastern United States. Rivercane still occurs as an understory component of bottomland hardwood forests, but with intense agricultural development over the past 200 years, canebrakes are now considered a critically endangered ecosystem. There is increasing interest in the use of A. gigantea in riparian restoration and soil stabilization. Additionally, A. gigantea possesses cultural significance to Native Americans as a major component of construction, basketry, and weapon making. This research assesses response of A. gigantea to existing plant assemblages and to site preparation techniques, when planted with primarily native grasses (primarily big bluestem, Andropogon gerardii, and Indiangrass, Sorghastrum nutans) and primarily exotic grasses (primarily Johnsongrass, Sorghum halepense, and Bermudagrass, Cynodon dactylon). Treatment effectiveness and competitiveness with existing vegetation are being determined by culm height, diameter, and density, production of new culms, cane spread, and cane biomass. This research should contribute to improving the success of future cane restoration projects by determining the interaction of cane with other grasses, as well as its response to frequently used site preparation techniques with and without competitors.

O5.9 HEATHER GRISCOM¹. James Madison University¹. Niche differentiation of Castanea dentata (American chestnut), Castanea hybrids, and other native tree species in Virginia.

Performance of historically, co-occurring canopy tree species, *Castanea dentata* Marsh. Borkh., *Liriodendron tulipifera* L., *Quercus prinus* L., and *Castanea* hybrids were monitored to better understand niche differentiation in a forest environment. The null hypothesis was that seedling performance does not differ as a function of resource gradients. Light was manipulated in the greenhouse and within experimental forest gaps. Seeds were planted in two soil types and seedling performance was measured after two growing seasons. Species were significantly different from each other with *L. tulipifera* showing the greatest performance in the field. Mesic slope soil had a significant positive effect on seedlings in the field where seedlings grown in xeric, ridge soils were more susceptible to desiccation. More light had a significant positive effect on seedlings in the greenhouse but only on diameter in the field. The interaction between light and soil was significant in both environments. In the field, species performed better in mesic slope soils

under high light conditions and ridge soils in lower light conditions. Overall, highest survival was found in ridge soils in 40-50% light with the exception of *L. tulipifera* which had the highest survival rates on mesic soils in small gaps. Difference in survival was due to an unexpected intermediate factor of rodent predation of *Castanea* and *Q. prinus* in mesic soils within small gaps. Survival data supports the fundamental niche theory. Results have implications for the restoration of *Castanea* hybrids in terms of predicting seedling performance in a heterogeneous environment.

O5.10 CAITLIN COSTELLE, KELLI HARRIS, LYNDSEY BOLANOS, SHARON LEE, AND PATRICK CALIE. Eastern Kentucky University. <u>Dynamics of 17 populations of sunflowers (Helianthus annuus - Asteraceae) in central Kentucky</u>.

Native sunflowers (Helianthus annuus - Asteraceae) are commonly found on disturbed calcareous substrates (such as road and highway embankments) in central Kentucky. We have been observing a marked decline in numbers of plants in up to 17 spatially distinct populations through a six year longitudinal study (2004 – 2009). This decline is notable in that the species is rather adventitious, colonizing disturbed habitats in a landscape highly impacted by human activity. All examined populations have exhibited either marked declines in numbers of individual plants, or complete extirpation from 2004 - 2008. A set of 7 populations was examined as follows. First, isoyme analysis was utilized to determine if a lack of genetic diversity could be a contributing factor of this decline. Second, seed germination studies were conducted to assess levels of reproductive potential. Of 13 isozymes examined polymorphisms were observed for 10 enzyme systems, with interpopulation variability exceeding intrapopulation variability. In randomly sampled sets of viable seeds germination rates in a controlled environment ranged from 32%-41%, with a mean value of 39%. Remarkably, four populations that exhibited declines over the prior five years of this study experienced marked increases in the final year of this study, the most dramatic being an increase of 7 individuals in 2008 to 1,462 in 2009 in a single population. We attribute this marked change to local precipitation patterns, as there is a coincidental increase in the amount of total annual rainfall in 2009 over the prior five years.

O5.11 KEITH GILLAND AND BRIAN C. McCARTHY. Ohio University. <u>Site-Specific Factors and the establishment of American chestnut (Castanea dentata)</u> on reclaimed mine lands.

American chestnut (Castanea dentata) once accounted for a large portion of the Eastern Forest canopy until the introduction of Chestnut blight (Cryphonectria parasitica). As a result, the species was effectively removed from canopy dominance by the 1930's. A backcross breeding program conducted by The American Chestnut Foundation has yielded a blight-resistant Chinese/American hybrid tree. Characteristics of the American chestnut may make it an ideal candidate for use on former coal-mine lands being reclaimed with Forestry-Reclamation Approach methods. However, questions regarding best methods for reintroduction methods remain unanswered. The aims of this study were to determine which site-specific factors affect the survival and performance of American chestnut, and develop a soil-color based system for determining which sites are ideal for reintroduction of American chestnut. The study was conducted at the Jockey Hollow Wildlife Management Area in Belmont County, Ohio. Six hundred sixty seeds were planted on a two year old reclaimed mine site in 2008 in 130 experimental blocks of five seeds. Seeds were monitored for germination, survival and height growth over two years. The site-specific factors measured were slope, aspect, soil pH, moisture, C, N, vegetative cover and extractable nutrients. Survival was found to be significantly (P < 0.05) affected by slope, aspect and soil pH. Growth was significantly affected only by soil Nitrogen. Significant differences in soil pH, soil C, N, and moisture between soil colors but no

significant difference in survival or height was seen. These results will provide much needed guidance as American chestnut is reintroduced.

O5.12 ROBYN M. NADOLNY AND ROBERT K. ROSE. Old Dominion University. Growth and Survival of Volunteer Loblolly Pine (*Pinus taeda*) Trees in an Oldfield in Eastern Virginia.

Old field succession to mixed hardwood forest is often prefaced by the invasion of open spaces by fast-growing loblolly pines (*Pinus taeda*). We examined growth rates, sources of mortality and demographics of volunteer loblolly pine trees within a 1.23 ha oldfield study grid in Chesapeake, Virginia. In the winter of 2005 we learned that 15.1% of 15,675 pine trees in a 5-year-old oldfield had been killed by girdling, and a further 50.0% partially girdled, by a high density of hispid cotton rats (*Sigmodon hispidus*). Three years later we examined sources of mortality after the rodent population had dropped to near zero. During the winter of 2008 the 7-year-old pine forest lost 138 trees (0.8%) to girdling but 23.0% (3,846 stems) to natural mortality, among 16,766 stems >0.8 m tall on a 1.23 ha grid. We measured the trees again in the winter of 2009-2010 to examine the rates of growth (basal area) from period to period, and to evaluate the effects of stem density on growth and survival.

O6.1 BRETT A DEGREGORIO^{1,2} AND AMANDA SOUTHWOOD². Bald Head Island Conservancy¹, University of North Carolina at Wilmington ². Temperature profiles within Loggerhead Sea Turtle (*Caretta caretta*) nests on Bald Head Island, NC.

An understanding of temperature regimes within sea turtle nests is crucial in determining patterns of nest site selection, incubation success, and hatchling sex determination. Temperature profiles inside of Loggerhead Sea Turtle nests were studied using miniature temperature data-loggers. Diel and seasonal temperature variation within nests were compared to those of adjacent sand at an equal depth. When nest temperatures were compared with outside nest temperatures, we found that outside nest temperatures fluctuate to a greater degree, indicating that nest chambers provide a more stable environment. Mean temperature of each nest during the middle third of incubation, referred to as the temperature sensitive period, was used to approximate hatchling sex ratios. Metabolic heating within nests becomes apparent during the temperature sensitive period, likely affecting resultant sex ratios. Sex ratio estimations based solely on sand temperature ignore elevated temperatures resulting from metabolic heating and therefore, we recommend that future studies incorporate direct monitoring of temperature within nests. Potential impacts of global warming on sex ratio production at this regionally important rookery are discussed.

O6.2 DARRELL WHITE, CHRISTINE SMALL AND BREANNA HARGBOL. Radford University. <u>Allelopathic influences of the invasive Ailanthus altissima</u> on a native and non-native herb.

As a highly aggressive, non-native invasive and allelopathic species, *Ailanthus altissima* (tree-of-heaven) has the capacity to negatively affect native. We examined effects of *A. altissima* on the establishment and growth of two herbaceous species common in invaded natural areas. Soil samples were collected from six replicate *A. altissima*-dominated stands and six control stands (no *A. altissima* present) in Appalachian mixed-oak forests of southwestern Virginia. Two target species, *Verbesina occidentalis*, native to the southeastern US, and *Dipsacus fullonum*, non-native and invasive throughout much of North America, were selected for their presence in both *Ailanthus*-dominated and control stands, high germination success, and contrasting native / invasive status. Germination and growth of target species were monitored in greenhouse flats for six weeks. We found severe reductions in all measured aspects of *V. occidentalis* when grown in *Ailanthus*

versus control soils, including seed germination (p = 0.002), seedling height (p = 0.001), leaf production (p < 0.001), and root:shoot ratio (p = 0.008). In contrast, D. fullonum appeared remarkably resistant to allelopathic effects, with no significant differences in germination or growth relative to soil type (p > 0.25 for all measures). Our results support the role of allelopathy in the invasive success of A. altissima and further suggest that A. altissima may differentially affect resident native versus non-native species, potentially facilitating the spread of other non-natives in the invaded community.

O6.3 HOWARD S. NEUFELD¹, DERICK B. POINDEXTER¹, PAULA MURAKAMI² AND PAUL SCHABERG². Appalachian State University¹ and U.S. Forest Service Northern Research Station². Observations on the relationship between above and below-ground anthocyanin production in *Galax urceolata* growing in sunny and shady habitats.

Galax urceolata (Poir.) Brummitt (Diapensiaceae) is a common evergreen herb of southern Appalachian forests. During fall and winter, leaves of plants exposed to high light produce substantial amounts of anthocyanins. These flavonoids attenuate excess bluegreen light and prevent photoinhibition of the spongy mesophyll cells. Interestingly, belowground organs (e.g., rhizomes) also produce anthocyanins, although their function there is currently unknown. We wanted to determine if there was a relationship between above and belowground anthocyanin production for plants in the field. We sampled Galax ramets from three populations over two different seasons (Mount Jefferson State Natural Area in fall 2007 and Grandfather Mountain in fall/winter 2009-2010) in both sunny and shady habitats. In both locations, there were significant positive correlations between leaf and rhizome anthocyanin contents, with plants in sunny habitats producing more anthocyanins than those in shady habitats. Interestingly, in 2009-2010 there were no differences in carbohydrate contents between sun and shade rhizomes although starch decreased through time, while soluble sugars tended to increase. These results suggest that light is not always required for the synthesis of anthocyanins as is commonly thought. Furthermore, there appears to be some form of communication between leaves and rhizomes with respect to anthocyanin formation although the nature of that signal is not known. Lastly, the adaptive significance of belowground anthocyanins in Galax is still unresolved.

O6.4 SHERI SHIFLETT AND DONALD YOUNG. Virginia Commonwealth University. Comparisons in water relations of three evergreen shrubs in an eastern temperate forest understory.

Water storage of three evergreen understory shrubs was characterized in a temperate environment to understand the physiological strategies for survival in the forest understory. The three species represent different families and include *Morella cerifera* (Myricaceae), *Ilex opaca* (Aquifoliaceae), and *Kalmia latifolia* (Ericaceae). Differences in wood anatomy were related to water relations parameters for these three evergreen shrubs. Measurements of wood density, stem and leaf capacitance, relative water content, specific leaf area, stomatal density, stomatal size, stomatal conductance, and soil moisture were taken. These measures were conducted using five leaves from five individuals of each species except for capacitance measures where three leaves and three stems were selected from each species. Mature leaves from first-order branches were selected for leaf measurements and third-order stems were selected for stem measurements. Interspecific differences in wood density reflect differences in capacitance and hydraulic conductivity among the three evergreens and may be indicative of variable adaptive strategies for survival in a light limited and periodically water limited understory. Understanding the physiological strategies of these species will lead to an understanding

of which temperate species would be able to tolerate predicted effects of increasing temperatures and shifts in precipitation expected with global climate change.

O6.5 STEVEN T BRANTLEY, JULIE C NAUMANN AND DONALD R YOUNG. Virginia Commonwealth University. <u>Application of hyperspectral vegetation indices for predicting leaf area index in Morella cerifera and Elaeagnus umbellata shrub thickets.</u>

Leaf area index (LAI) is a key characteristic of plant canopies directly linked to ecosystem productivity and accurate values of LAI are essential for monitoring ecosystem C stocks. Direct measurement of LAI, even in small areas, is labor intensive, impractical at large scales, and does not capture seasonal or annual variations. The need to accurately measure LAI repeatedly at large scales makes remote sensing an efficient technique for estimating LAI; however, many vegetation indices, such as Normalized Difference Vegetation Index (NDVI), tend to saturate at LAI levels >4. Using two monospecific shrub thickets as model systems, we evaluated the sensitivity of hyperspectral algorithms specifically developed to differentiate LAI values >4. We also tested the potential of indices developed to detect variations in tissue chemistry and/or physiological stress to estimate LAI. Indices were tested against data from direct measurements of LAI (litterfall) rather than indirect measurements which are also known to saturate at high LAI values. For the two canopies studied here, algorithms intended to improve accuracy at high LAI values in agricultural systems were insensitive when LAI exceeded 4 and offered little improvement over NDVI. The reliability of vegetation indices currently used to estimate LAI may be greatly overstated because "ground-truthing" is often accomplished with indirect methods that also saturate at high LAI values. Our results suggest that vegetation indices based on wavelengths in the near infra-red, and specifically developed for stress detection, have the highest potential to accurately estimate LAI.

O6.6 JENNIFER BOYD AND J. HILL CRADDOCK. University of Tennessee at Chattanooga. Not made for the shade? Comparing the shade tolerance of Castanea dentata, Castanea mollissima and their hybrids.

Efforts are underway to restore blight-devastated Castanea dentata (American chestnut) to the deciduous forests of eastern North America. These include a backcross breeding program that produces hybrids with the morphological characteristics of C. dentata and blight resistance of C. mollissima (Chinese chestnut). However, C. mollissima differs in some other possibly significant ways from its American congener. Perhaps most obviously, C. mollissima is relatively short with a broad crown and prefers sunny open exposures, while C. dentata historically contended with the shady forest understory prior to growing very tall into the well lit canopy. These differences suggest that C. dentata and C. mollissima could differ substantially in shade tolerance, an invisible yet potentially important characteristic to consider when interbreeding these species for restoration purposes. Certain photosynthetic properties can provide insight into the shade tolerance of plant species. Specifically, high maximum rates of photosynthesis in response to increasing light (A_{max}) indicate shade intolerance, while low light compensation points (LCP) indicate shade tolerance. We are conducting a greenhouse- and field-based experiment to investigate the shade tolerance of young C. dentata and C. mollissima, as well as their immediate hybrids and late backcrosses. Preliminary results indicate that immediate hybrids retain photosynthetic characteristics more similar to their shade intolerant Chinese parent than their more shade tolerant American parent. Our completed results should aid chestnut breeders in understanding how shade tolerance can be influenced by parent species and land managers in selecting appropriate sites for reintroduction trials of hybrid chestnuts.

O6.7 ALLISON ROLLINS, CARLY WINTERS, JENNIFER ZETTLER, BIL LEIDERSDORF, AND GREG KNOFCZYNSKI. Armstrong Atlantic State University. Does a diet of native versus non-native ants affect antlion development?

The red imported fire ant, Solenopsis invicta, is a widespread, invasive species in the southeastern United States. This aggressive ant can outcompete and displace other ant species. We wanted to determine if the development of predaceous antlions can be affected by an exclusive ant diet. The study was conducted with second instar, pit-building Myrmeleon mobilis antlions and three different species of ants all collected in Savannah, Georgia. The antlions were randomly assigned to three treatment groups that were fed either a diet of S. invicta, the indigenous pyramid ant Dorymyrmex bureni, or the native big-headed ant Pheidole dentata. Measurements were taken each month for all antlion head widths and weights. After four months, antlions fed on a diet of pyramid ants had the largest average head widths. Conversely, antlions fed a diet of P. dentata had the lowest overall weight gain. Mortality and pupation rates did not differ between treatment groups. Thus, we found that diet does appear to affect antlion development. However, a diet exclusively made up of the red imported fire ant does not impair larval antlion development.

O6.8 NICHOLAS LEVELSMIER¹, VANESSA SANDOVAL¹, CASANDRA REYES-GARCIA², THOMAS MCELROY¹, JOSE LUIS ANDRADE², JUAN MANUEL DUPUY², PAULA C. JACKSON¹. Kennesaw State University¹, Centro De Investigacion Cientifica De Yucatan². Photosynthetic Rates for Three Tree Species Growing in Plots of Different Successional Age in a Tropical Dry Forest of Yucatan, Mexico.

Photosynthetic rates were determined for three tree species (*Piscidia piscipula*, *Bunchosia swartziana*, and *Psidium sartorianum*) growing in quadrats of different successional age (15 and 60 years) in a semi-deciduous tropical dry forest in the Yucatan Peninsula of Mexico. We hypothesized that because forests change over time, that the age of a secondary forest would potentially affect the photosynthetic rate of local species. We predicted that individuals found in stands of younger age would show higher overall photosynthetic rates than those found in stands of older age. Photosynthetic rates were determined in the wet (May 2008) and dry (July 2009) seasons by generating light curves on 5 individuals of each species in each plot using a Licor 6400 Photosynthesis System. In the dry season, all species exhibited higher mean maximum photosynthetic rates in the younger plot (15 years of secondary succession). However in the rainy season, one of the species (*Bunchosia swartziana*) presented higher mean maximum rates in the older plot (60 years). Potential implications for differences among plots, species, and seasons will be discussed.

O6.9 SPENCER N. BISSETT AND DONALD R. YOUNG. Virginia Commonwealth University. Responses to salinity exposure by the coastal nitrogen-fixing vine <u>Strophostyles helvola</u>.

Spatial variations in physiology, leaf diurnal movements, and biomass allocation were evaluated for the vine *Strophostyles helvola* (Fabaceae) across a Virginia barrier island, to compare effects of salinity exposure. *S. helvola* has been identified as sensitive to high salt concentrations, but is found in close proximity to both the ocean and bay sides of Virginia barrier islands, where sea spray is a prevailing stress on these and other vines with twining or scrambling growth forms. We measured photosynthesis, stomatal conductance, relative water content, leaflet angle, azimuth, and temperature, and tissue chloride concentration (leaf and stem tissues) to evaluate plant responses to various levels of salt exposure across the island. Additionally, seeds were exposed to various

representative stresses to simulate environmental conditions of importance in the natural habitat. We conducted viability analyses to compare the effects of heat, scarification, and salinity treatments on seed germination. Differences in plants between sites suggests that salinity exposure affects the ability of *S. helvola* to compete with neighboring vegetation, but does not fully inhibit its success. Because *Strophostyles* species are symbiotic nitrogen-fixers, their presence on coastal margins may be an important contributor to nutrient budgets, and because such species may also facilitate dune-building processes and are instrumental in the decline of mature woody shrub thickets, *S. helvola* and related species may be considered as driving influences at early and late stages of succession in these highly dynamic and sensitive environments.

O6.10 CARRIE C. KLASE AND AMY E. BOYD. Warren Wilson College. <u>Do wine-red Calycanthus floridus flowers elevate intrafloral temperature relative to ambient conditions?</u>

Several unrelated spring-blooming southeastern plants share an unusual suite of floral characteristics, including wine-red corollas and a similar stinky fragrance. These characteristics may be associated with a shared pollinator assemblage in the spring forests, but other hypotheses need to be considered. One potential advantage of dark red coloration may be that the color absorbs and traps heat passively, or serves as a visual indicator of thermogenesis. Warmer flowers may benefit plants by attracting ectothermic insects that could serve as pollinators, by promoting pollen tube growth or fertilization in cold weather, or by increasing volatilization of floral scent to attract pollinators. To determine if Calycanthus floridus flowers present a warmer microenvironment, we measured internal floral temperature of 30 flowers at several times across the day for three days and compared these temperatures to ambient temperatures near the flowers. Results were quite variable, with flowers cooler than ambient temperatures at three collection times, flowers warmer than ambient temperatures at three collection times, and no difference at two collection times. Similar variable results were found in comparable experiments with white-flowered spring ephemerals, and no correlation with weather patterns was found. We conclude that the flowers of Calycanthus floridus do not present an internal floral environment consistently warmer than ambient temperatures. Floral visitors are most likely attracted to other rewards within the flowers, and other factors likely contributed to the evolution of wine-red corollas.

O6.11 KRISTIN SCHWARZAUER, JAMES RAYBURN AND SAFAA AL-HAMDANI. Jacksonville State University. <u>The Potential Use of *Pueraria montana* var. *lobata* in Phytoremediation.</u>

Kudzu (*Pueraria montana* var. *Iobata*) is a legume vine well adapted to the Southern region of the United States with a growth rate exceeding 30 meters per year. Kudzu was evaluated in the remediation of the heavy metal Pb in a greenhouse under controlled environmental conditions. The influence of lead concentrations (0, 100, and 200 mg/L) on selected physiological responses was also assessed. Kudzu was shown to continue to grow and photosynthesize at relatively high concentrations of Pb. Kudzu appeared to increase the production of antioxidants in response to the increase in the lead concentration. This defense response appeared to be true in response to the EDTA as well with a significant increase in comparison to the control. Results have shown a 30-35% uptake of the total contamination of lead. Therefore, kudzu can be considered as a hyperaccumulator for lead.

O6.12 JACLYN K. VICK AND DONALD R. YOUNG. Virginia Commonwealth University. Edaphic variation and physiological strategies controlling dune forb distribution on a Virginia barrier island. Climate change induced sea-level rise, increased temperatures, and increased storm frequency and intensity may lead to local extinctions of native flora on coastal dunes if populations are unable to adapt or migrate. Physiological integration of clonal species may be advantageous as dunes become more resource limited. We compared the distribution of two clonal forb species, Cirsium horridulum and Rumex acetosella, and a taprooted forb, Conyza canadensis on Virginia barrier island dunes. For each species we obtained leaf C:N, %N, δ13C, δ15N, relative water content, and tissue chlorides to determine the relationships between spatial distribution and specific physiological strategies on coastal dunes. We also quantified environmental characteristics including depth to the water table and soil chlorides for each dune. Cirsium horridulum had the highest δ^{13} C (-27.1 ± 0.1 %) indicating greater water use efficiency (WUE). Cirsium horridulum had the largest range of C:N values suggesting a more plastic nitrogen use efficiency (NUE). Rumex acetosella was absent from primary dunes where soil salinity was highest, $11,108 \pm 1,389 \, \mu g/g$. Conyza canadensis was not present on tertiary dunes where the water table was closest to the surface, indicating Conyza canadensis is less competitive for water and/or nutrients. Rumex acetosella populations may decline as sea level rises and storms increase, resulting in higher salinity. Conyza canadensis populations may decline if depth to the water table increases from higher temperatures. Community composition may be altered and dune stability jeopardized as climate changes unless plant adaptations and/or migrations keep pace with environmental change.

O7.1 MAX LANNING AND KATHY MATHEWS. Western Carolina University. <u>The Southern Appalachian saxifrage species complex: Micranthes careyana and M. caroliniana</u>.

Recent phylogenetic analyses have clearly shown the large, arctic and north-temperate genus Saxifraga (Saxifragaceae) sensu lato is polyphyletic with two distinct clades: Saxifraga sensu stricto and Micranthes. Six species of Micranthes exist in the Southern Appalachians, two of which have been difficult to identify in the field. Taxonomists have traditionally distinguished the very similar M. careyana and M. caroliniana primarily based on geographic locality and four morphological characters: sepal orientation (erect or reflexed), filament shape (uniform or club-shaped), petal coloration (none or 2 yellow spots), and fruit length (2.5-5 or 4-5 mm). The goal of this research was to examine these characters to clarify the taxonomy of these species and look for molecular differences in nuclear and chloroplast DNA regions. Several flowering populations of M. careyana and M. caroliniana from the Blue Ridge Physiographic Province were examined and leaf material was collected for molecular analyses. Populations in the counties of Ashe, Alleghany, Watauga, North Carolina and Johnson, Tennessee displayed fully reflexed sepals and club-shaped stamen filaments, consistent with descriptions of M. caroliniana. Populations examined in flower in all other counties displayed erect sepals and uniform stamen filaments, consistent with descriptions of M. careyana. Petal coloration and fruit size were not useful characters in distinguishing these taxa. These differences in floral characters are correlated with mutations in ITS and trnL-F sequences. In phylogenetic analyses, populations determined to represent M. caroliniana appear in a distinct clade from those determined to represent M. careyana, supporting the separation of the two taxa as species.

O7.2 RANDALL TERRY. Lamar University. <u>Re-evaluation of Morphological and Chloroplast DNA Variation in Juniperus osteosperma Hook and Juniperus occidentalis Torr. Little (Cupressaceae) and their Putative Hybrids.</u>

Relationships between variation in cpDNA and morphology were examined to test the hypothesis of hybridization between *Juniperus osteosperma* and *Juniperus occidentalis*. Principal components analysis of 11 taxonomically-important characters distinguished individuals collected from eastern Nevada and Utah from those of southern Oregon. In

contrast, many individuals collected from sympatric populations in western Nevada were morphologically intermediate between the two species. Comparative sequencing of the trnS-trnG intergenic spacer and restriction site analysis of a trnL-trnF PCR product revealed nine distinct haplotypes and examination of morphology-haplotype associations allowed identification of species-specific markers as well as those that transcend taxonomic boundaries. The occurrence of haplotypes characteristic of one species in the morphological background of the other, the confinement of morphological intermediacy to zones of sympatry, and the differentiation of intermediacy resulting from divergence from that expected from interspecific gene flow are all cited as evidence for introgressive hybridization between *Juniperus* osteosperma and *Juniperus* occidentalis.

O7.3 NADIA TALENT, RON W. LANCE, AND TIMOTHY A. DICKINSON. Royal Ontario Museum. North American Crataegus (Rosaceae) centers of diversity: a fundamentally different character in the east and west?

Recent revisionary work shows an abundance of Crataegus forms in the northwestern U.S. and southwestern Canada that invites comparison with the great diversity in the southeast, particularly because farm abandonment, which suggests hybridization opportunities, is more recent in the northwest. Our results, however, show a majority of strongly apomictic polyploids in the west, and greater morphological diversity with little molecular divergence and relatively more sexually reproducing diploids in the southeast. Molecular phylogenies have so far shown little structure in a large clade from the southeast, and much clearer structure in smaller clades with wider distributions. For example, C. crus-galli is one of the most readily identifiable widespread eastern forms that at northern latitudes is apomictic and separates into 10-stamen tetraploids and 20-stamen triploid-tetraploid mixtures. Similar patterns also occur in sections Douglasianae and Rotundifoliae, but in Georgia and Alabama there are diploid C. crus-galli with variable stamen numbers. Glacial history indicates a more unitary refugium in the southeast in contrast to many small refugia in the northwest that have produced diversification in other plant groups. Rare tetraploid partial apomicts may be central to diversification in the northwest. In the southeast additional factors are probably implicated, apparently including higher levels of historic and present-day hybridization. Tools are now available with which refractory biological and systematic problems like those posed by the genus Crataegus can be addressed. What is initially needed is fieldwork focused on readily distinguished complexes combined with the collection and analysis of morphometric, breeding-system, and molecular data.

O7.4 CHARLES HORN. Newberry College. <u>Heterophylly in the aquatic plant Didipilis diandra (Lythraceae).</u>

Many aquatic plants are known for expressing different morphological forms in different habitats, especially in transition between submersed and emersed forms. During observation of *Didipilis diandra* (Lythraceae) at several locations in North Carolina during July 2008, it was realized that this species clearly exhibits heterophylly. *Didipilis diandra* is a small aquatic plant that is found widely scattered in eastern North America, typically growing in shallow water or along shorelines of streams and ponds. Analysis of leaf size of collected plants revealed that submersed leaves are flaccid and average 15.4 mm long by 1.6 mm wide. As stems elongate to the water surface, shorter floating leaves are produced and flower production is initiated. Finally, emersed leaves are produced on decumbent stems that produce abundant flowers lacking petals. Leaves on these emersed plants average 6.3 mm long by 1.2 mm wide. This variation in growth morphology of *Didipilis diandra* has created identification confusion as *Rotala ramosior*, also of the Lythraceae, grows in similar habitats of stream and pond shorelines. However, *Rotala ramosior* grows entirely emersed and is a strongly erect herb with visible petals.

O7.5 ROLAND P. ROBERTS, DONALD R, SMITH III, AYODEJI OLUYADI, BRYON SELLMAN, AND CHAO YANG. Towson University. <u>Phylogeography of Arabidopsis lyrata ssp lyrata (Brassicaceae) in eastern North America.</u>

Arabidopsis Iyrata ssp Iyrata (L.) O'Kane & Al-Shehbaz (Brassicaceae) grows in a mosaic of low competition habitats along the northeastern seaboard. Plants growing on three shale, limestone and serpentine, have exhibited distinct different substrates, morphological characteristics in their rosette growth stage. These differences have been replicated in common garden experiments using seeds collected from plants on all three substrates. We used sequences of the tmL intron and the tmL-tmF intergenic spacer to investigate the relationships among populations of this taxon occurring on the three different substrate types in Maryland, New York and Virginia. The tmL, tmL-trnF data indicate greatest haplotype diversity within one of the Maryland populations, Soldiers Delight. Three private haplotypes were found in the Soldiers Delight population and one in the Dover Plains (New York) population. The other two haplotypes were present in either two or three of the sampled populations. Also, southern populations harbored a wider variety of haplotypes compared to northern populations, a pattern usually associated with the presence of refugia or centers of genetic diversity. To further explore this phenomenon and highlight the relationships among the sampled populations we have expanded our sampling of populations and have added data from two other chloroplast DNA regions, trnH-psbA and atpB-rbcL. We have successfully amplified the trnH-psbA region and are exploring the diversity and distribution of haplotypes in relation to population location and substrate type. The atpB-rbcL region will be similarly analyzed for all sampled populations.

O7.6 ROLAND P. ROBERTS, NATALIA CEAICOVSCAIA, KEMARDO HENRY AND GAGANPREET SINGH. Towson University. The rabbitbrush saga continues: Insights from combined analyses of nuclear and chloroplast sequence data.

Chrysothamnus spp. (rabbitbrush) along with Artemisia, dominates the sagebrush ecosystem of the southwestern United States. This ecosystem extends into Mexico and Canada making it one of the largest in western North America. The taxonomic position of Chrysothamnus within tribe Astereae and subtribe Solidagininae is unequivocal. However, the relationships among species of Chrysothamnus and those of recently segregated genera remain in doubt. Analyses utilizing nuclear ribosomal DNA (nrDNA; ITS and ETS) resulted in a redefinition of a now monophyletic Chrysothamnus. However, the nrDNA analyses failed to fully resolve relationships among species both within Chrysothamnus and among species of Chrysothamnus and those of related genera. We have expanded sampling of species of Chrysothamnus and related genera from within their known distribution range. Also, several chloroplast regions were amplified and sequenced in each sampled taxon. This sampling strategy allowed us to assess relationships among Chrysothamnus species and those of related genera. In addition, we were able to assess congruence between chloroplast- and nuclear-based hypotheses of relationships. Analyses of the combined chloroplast data resulted in increased resolution of evolutionary relationships across all sampled taxa. Combined analysis of the chloroplast and nrDNA data yielded stronger support for some of the major lineages within subtribe Solidagininae and greater resolution of intra- and intergeneric evolutionary relationships.

O7.7 JOHN KARTESZ AND MISAKO NISHINO. Biota of North America Program. Phytogeography and Taxonomy of the North American Flora Assessed by way of Digital Technology.

Our knowledge of North American floristics is predicated upon four centuries of vouchered collections that number some 80 million records. Therefore, our basic knowledge of floristics is no longer a mystery. By using even antiquated floristic practices, we can generate informative traditional floras with a great deal of precision regarding where do

our 23,000 species occur within North America, how do we identify them, which ones are rare, which ones are exotic, what characteristics do they share, etc. However, by applying many new and readily available alternative technologies to these antiquated floristic practices, new and wholly different paradigms can be produced. In the Southeast, we know from herbarium records that there are 7,728 species of vascular plants, of which 5,517 are native, 2,261 are exotic, 880 are trees, 1,663 are shrubs, etc. However, by incorporating Digital Technology, it is also possible to show richness and similarity coefficients of floras from different elevations, from different ecoregions, from different heat and hardiness zones and from different physiographic zones. Digital Technology can also produce species area curves, illustrate density gradation patterns and compare floras with similar rainfall, heat and hardiness zone patterns. It is also possible to monitor floristic shifts due to climate factors such as global warming and other factors. Moreover, by using random access keys and digital imagery, we can produce more effective identification systems and more accurately pinpoint locations of individual plant populations, or even individual plants that grow in parks, forests or along roadsides.

O7.8 HERRICK H. K. BROWN¹, KATHERINE A. BOYLE¹, DIXIE Z. DAMREL³, JOHN B. NELSON² AND ALBERT B. PITTMAN¹. South Carolina Department of Natural Resources Heritage Trust Program¹, University of South Carolina Herbarium (USCH)², Clemson University Herbarium (CLEMS)³. Specify and beyond: Broader applications for natural history collections databases.

Through cooperation with SCDNR Heritage Trust (HT) staff, the University of South Carolina and Clemson University herbaria initiated an effort to upgrade existing collections databases to the Specify software system. Beginning in 2007, a successful data migration for both collections was completed within one year and made over 100,000 herbarium specimen records available online. HT staff realized the utility of the online data by updating the South Carolina Plant Atlas with previously undocumented county occurrence records. Further, HT staff used the online collections information in consideration for updates to the list of tracked plant species in South Carolina and added several previously undocumented element occurrence records for tracked species to the HT database. Additional benefits of data standardization and herbarium outreach efforts include the potential contribution to regional datasets and increased public exposure as evidenced by web usage statistics. Among those accessing the online collections data are numerous private individuals, educational institutions and other government agencies. Access to collections records also prompted requests from researchers conducting biogeographic and revisionary studies in need of more detailed specimen information. We showcase the importance of natural history collections and the utility they provide in facilitating research efforts and helping natural resource agencies make better informed management decisions.

O7.9 M. STEVEN FURCHES AND RANDALL SMALL. University of Tennessee. The role of hybridization in generating species- and population-level diversity in *Sarracenia*.

Sarracenia is genus of rhizomatous, perennial herbs centered in the southeastern United States with one species extending into New England and Canada. They are primarily found in sphagnous bogs, mountain seeps, and longleaf pine savannas. The group has long been popular in cultivation due both to their beauty and their carnivorous habit. Nearly all geographically-possible hybrids have been found in nature, as well as many complex hybrids in cultivation. However, the extent of natural hybridization and its role in generating morphological diversity in the group remains largely unknown. Our study uses a combination of non-coding chloroplast regions, microsatellites, and nuclear gene regions to examine patterns of diversity and relationships within the genus.

O7.10 CHRIS STOEHREL AND KATHY MATHEWS. Western Carolina University. Phylogeny of the *Trillium erectum* complex.

In the Southern Appalachian Mountains there are six pedicellate members of the genus Trillium that are known to hybridize in the wild and the offspring produced are known to be developmentally normal and fertile. These six species (Trillium erectum, T. vaseyi, T. sulcatum, T. rugelii, T. simile, and T. flexipes) along with the northern species (T. cernuum) comprise the Trillium erectum complex. It is difficult to tell whether these are newly divergent species that are still developing reproductive isolation; or if these are species that were once completely reproductively isolated from one another, who are now experiencing an overlap in gene pools due to habitat or pollinator changes. More investigations need to be done to determine the phylogeny within the complex, and to create a measure the level of gene flow between populations and over geographic areas. We collected leaf tissue from T. erectum, T. vaseyi, T. sulcatum, T. rugelii, T. simile, and T. flexipes from populations in North Carolina, Georgia, Tennessee, and South Carolina. The chloroplast trnL gene region was amplified and sequenced. Sequences for T. camchatense, the outgroup, were obtained from Genbank. Preliminary results show only 1% variation between species yet despite known introgression individuals from allopatric and sympatric populations group with members of the same species.

O7.11 ANNA BECKER AND RANDALL SMALL. University of Tennessee. <u>Population</u> genetics of *Penstemon tenuiflorus* and *P. hirsutus* (Plantaginaceae).

Understanding the relationship between genetic diversity and geographical distribution is essential for the conservation of rare species. However, the identification of factors contributing to rarity can be difficult in the presence of confounding variables. The comparison of narrowly distributed endemics with widespread congeners is an invaluable tool for eliminating such variables; our study compares sister taxa *Penstemon tenuiflorus* and *P. hirsutus* (Plantaginaceae). These species are hypothesized to be closely related, however their placement within the *Penstemon* phylogeny has yet to be resolved. While *P. tenuiflorus* has a narrow distribution localized to central Tennessee, the range of *P. hirsutus* extends from northern Tennessee into southeastern Canada. Although *Penstemon* generally experiences high levels of interspecific hybridization, *P. tenuiflorus* and *P. hirsutus* have never been observed to hybridize in nature, which is particularly puzzling given their remarkable similarity and overlapping distributions. In order to assess genetic divergence between and within species, our research utilizes a combination of molecular markers: a nuclear gene, a non-coding chloroplast DNA region, and microsatellite loci.

O8.1 MARC A MILNE AND DEBORAH A WALLER. Old Dominion University. <u>Spider residency contributes nutrients to the purple pitcher plant, Sarracenia purpurea.</u>

Funnel-weaving spiders of the genus Agelenopsis commonly build webs that funnel into the leaves of the purple pitcher plant, Sarracenia purpurea. Spiders were observed conducting this behavior in the field and were collected and identified. In addition, we determined the effect pitcher residency by Agelenopsis had on nitrogen captured by S. purpurea using stable isotope signatures. $\delta^{15}N$ values were measured for prey (crickets), fed Agelenopsis, unfed Agelenopsis, direct-fed S. purpurea pitchers, S. purpurea pitchers fed Agelenopsis-resided filter paper, S. purpurea pitchers fed empty filter paper, and Agelenopsis-resided pitchers. The $\delta^{15}N$ signature of Agelenopsis increased when they were fed prey. S. purpurea pitchers fed Agelenopsis-resided filter paper and A.emertoni-resided pitchers both had $\delta^{15}N$ values higher than pitchers fed empty filter paper yet were no different than pitchers directly fed prey. In addition to these data, the increased capture radius and efficiency of an Agelenopsis web compared to that of a S. purpurea pitcher suggests that S. purpurea may actually benefit from having an Agelenopsis resident.

O8.2 Canceled

O8.3 SONIA M. HERNANDEZ, LOGAN WEYGANDT², RON CARROLL³ and SUSAN SANCHEZ⁴. ¹ Warnell School of Forestry and Natural Resources and the Southeastern Cooperative Wildlife Disease Study, University of Georgia¹. John Hopkins Medical School². The Odum School of Ecology, University of Georgia³. The Athens Diagnostic Laboratory, College of Veterinary Medicine, University of Georgia⁴. Is the antimicrobial resistance of the fecal flora of Neotropical birds related to human activity?

After decades of antibiotic use, there is global concern about the emergence of antimicrobial resistance in livestock and humans. Environments and hosts influenced by human activity are hypothesized to be more likely to harbor bacteria that display a higher and wider prevalence/variety of resistance, and thus, could become sources of resistant bacteria. To test this hypothesis, we investigated the antimicrobial resistance pattern (AMRP) of wild birds that inhabited various gradients of human activity and compared it to flora from birds living in nearby forest fragments in Costa Rica. We obtained 306 Enterobacteriacae isolates from fresh fecal samples collected from 43 species of birds. The AMRPs were determined by finding the minimum inhibitory concentration (MIC) against 21 antibiotics. When each bacterial isolate was analyzed separately, a significant difference (p< 0.05) was noted for either genera or human activity for six antibiotics and for both parameters in two. E. coli isolates always displayed the lowest resistance, while Citrobacter and other genera were always similar, and significantly more resistant than E. coli. Significant differences due to human activity were found in 3 of the 26 antibiotics. The probability of multiple resistance for E. coli isolates was found to be significantly lower than for non-E. coli isolates. Similarly, the probability of multiple resistance was higher for high human persistence habitats vs. habitats with lower human activity. These findings highlight the need to further elucidate the variety of mechanisms that result in antimicrobial resistance, and more comprehensive studies on the ecology of bacterial flora.

O8.4 WHITNEY KISTLER^{1,2}, MICHAEL YABSLEY^{1,2}, DAVID STALKNECT², THOMAS J. DELIBERTO³, KYLE VAN WHY³, PAUL C. WOLF³, DARREN L. BRUNING³, JAMES C. CUMBEE³, RANDALL M. MICKLEY³, CARL W. BETSILL^{3,1} Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia, ² College of Veterinary Medicine, University of Georgia, ³National Wildlife Disease Program, Fort Collins, Colorado. <u>Evaluation of Canada geese</u> (<u>Branta canadensis</u>) as sentinels for detecting local transmission of avian influenza virus.

Little is known about local transmission and maintenance of avian influenza viruses (AIV). Canada geese (Branta canadensis) were tested as sentinels because they have a near ubiquitous distribution, are easy to sample, and frequent areas where other AIV hosts are present. To evaluate Canada geese as sentinels for AIVs, over 2,500 serum samples were collected from 9 states (GA, MA, MN, MS, NC, NJ, PA, WA, and WV) during the summers of 2008 and 2009. Agar gel immunodiffusion (AGID) and a commercial blocking ELISA (bELISA) assays were used to detect antibodies to AIV. The highest prevalence rates were detected in northern states (MA/PA/MN/NJ/WA, 19.6% bELISA) while southern states had a significantly lower prevalence (4.4% bELISA). Overall significantly more geese were positive by bELISA (11.9%) compared with AGID (3.1%). These results indicate that the bELISA assay is more sensitive than the AGID assay. Therefore, the AGID assay was not used during the second year of this study. The higher prevalence detected in northern states compared with southern states is in agreement with virus isolations from ducks, which indicates viral shedding is highest in northern wintering states. Furthermore, the results indicate high levels of exposure in geese and we believe that they can be effectively used as sentinels for regional and local transmission of AIV.

O8.5 KATHERINE F. FREEMAN AND AMY E. BOYD. Warren Wilson College.

<u>Dissection of sensory components of pollinator attraction to Calycanthus floridus</u> (Calycanthaceae).

Calycanthus floridus, a spring-blooming shrub, presents a somewhat unusual combination of floral characteristics, including dark red corollas and a fragrance similar to overripe, rotting fruit. In order to elucidate how these characteristics may serve to attract floral visitors, we sought to dissect the sensory components of pollinator attraction by using sticky traps presenting color and/or scent similar to that of the *C. floridus* flowers. Traps caught a diversity of small, ectothermic insects, including a wide variety of small flies and beetles as well as leafhoppers, other insects, and spiders. The common insects found in the traps were similar to that found within the *C. floridus* flowers as well as similar to the trap catch in similar experiments performed at populations of other wine-red flowered species. Insect catch within the traps show no significant differences between any of the treatments for any category of insect examined, though total insects captured was higher in green (uncovered) traps than in wine-red-colored traps. We tentatively conclude that the wine-red flower color is not an important component of floral attraction in this species, though further research is needed to elucidate the nature of pollinator attraction in *C. floridus* flowers.

O8.6 OLIVIA MESSINGER AND SEDONIA SIPES. Southern Illinois University Carbondale. Scents and sense-ability; host recognition in a specialist bee, Diadasia.

It is estimated that over half of the world's 30,000 bee species are specialists, collecting pollen from only a subset of host plants available to them. The means by which bees recognize their host plants are not fully understood, nor are the mechanisms governing their fidelity. This question becomes especially intriguing when considering specialist bee clades whose species have radiated onto multiple, distantly related host plant families. How do these evolutionary switches to new host plant families take place? Diadasia is a clade of specialists, different species of which specialize on distantly related plant families (Asteraceae, Onagraceae, Cactaceae, Malvaceae, and Convovulaceae). We have been investigating the visual and olfactory cues associated with Diadasia-visited members of each plant family. Here we present our preliminary investigation into the importance of visual and chemical cues in these host relationships. Using GC/MS, we analyzed 16 taxa used as pollen hosts by various Diadasia species, as well as eight co-blooming non-host plants. Floral scents from these host plants are typically high in sesquiterpenes, and at least eight compounds are shared across sampled taxa. Early results from behavioral studies of three Diadasia species indicate that visual elements (the presence of some floral structures) may also contribute to host recognition in Diadasia. Moreover, two species appeared more amenable to alternative hosts when normal hosts are not available, whereas one refused to switch under any circumstances.

O8.7 TERESA A. PORTER¹ AND JENNIFER CRUSE-SANDERS². Salem College¹, Atlanta Botanical Garden². <u>Cactus (Stenocereus stellatus)</u> domestication favors larger bat pollinators.

Domestication may contribute to genetic divergence from wild populations not only through direct human selection of preferred phenotypes, but also by altering interactions among pollinators. The extent to which artificial selection changes the genetic structure and diversity of a plant population should be mitigated in conditions of substantial gene flow from wild conspecifics. In central Mexico, many columnar cacti, including *Stenocereus stellatus*, grow both as wild populations and in cultivation with overlapping bloom times. *S. stellatus* are self-incompatible and depend on a few bat species for pollination. These bats may transfer pollen among wild and cultivated populations. Video

recordings of pollinator visits to *S. stellatus* flowers in cultivated and wild populations supported the suggestion from previous research that bats of the genus *Leptonycteris* partially exclude smaller-bodied bats, *Choeronycteris mexicana*, from the more densely flowering cacti in the home gardens, narrowing one potential avenue of gene flow. *Leptonycteris* represented a substantial majority of garden flower visits, whereas *Choeronycteris* were more commonly seen feeding from wild *S. stellatus* flowers.

O8.8 MELISSA SIMPSON, SEDONIA SIPES, AND KARA HUFF-HARTZ. Southern Illinois University Carbondale. The floral scent chemistry of Hibiscus moscheutos and Ipomoea pandurata, and the role of chemistry in host selection by the eastern digger bee, Ptilothrix bombiformis, an eclectic specialist.

The role of floral scent has been well-characterized in pollination systems involving moths, butterflies, bumblebees, and honeybees, but little is known about how chemistry mediates host selection by specialist bees. We used dynamic headspace sampling and GC/MS to compare the floral scent of *Hibiscus moscheutos* and *Ipomoea pandurata*, two known host plants of the specialist bee *Ptilothrix bombiformis*. Flowers of both species contain a diversity of sesquiterpenes, as well as aliphatics, aromatic compounds, and monoterpenes. Our analyses indicate that these plants share at least 14 compounds in their floral scent, which may play a role in the bees' ability to recognize and utilize both as nectar and pollen hosts. The floral scents of *H. moscheutos* and *I. pandurata* are differentiated from those of several other sympatric plant species representing abundant floral resources that are visited by generalist bees but not by *P. bombiformis*. Some of the compounds shared by *H. moscheutos* and *I. pandurata* are also found in the flowers of other plant taxa used as hosts by other emphorine bee species, and may have played an important role in host-choice evolution.

O8.9 STEPHEN J. BRZYKCY AND SEDONIA D. SIPES. Department of Plant Biology, Southern Illinois University Carbondale. Host plant recognition in the eastern digger bee (*Ptilothrix bombiformis* Cr.), an eclectic specialist.

Little is known about how specialist bees recognize their host plants. We conducted behavioral observations and choice experiments within a foraging population of Ptilothrix bombiformis Cr., a specialist bee that collects pollen mainly from Hibiscus spp. (Malvaceae), but also occasionally from Ipomoea spp. (Convolvulaceae). Our objectives were to 1) examine the role of flower color in host recognition by comparing the bees' preferences for three naturally-occurring color morphs of H. moscheutos and different colored cultivars of *H. moscheut*os, 2) quantify the bees' relative preferences for *H.* moscheutos and I. pandurata, and 3) elucidate the parameters of visual and chemical cues by offering the bees altered host flowers and non-host taxa. The bees visited the naturally-occurring H. moscheutos color variants and one cultivar equally, but rejected another cultivar completely. Removing the top or bottom two petals from *H. moscheut*os did not affect visitation rate, nor did adding I. pandurata pollen to the flowers. Removing all petals reduced visitation rate significantly, but not to zero. Visitation to *I. pandurata* did not differ significantly from H. moscheutos. Bees either refused or visited rarely for nectar the non-hosts offered. These included another mallow (Abutilon cultivar), an Ipomoea cultivar, white Petunia, white Petunia with Hibiscus pollen added, and two abundant, contemporaneously flowering native species (Asclepias incarnata, Silphium perfoliatum).

O8.10 ZNAR BARWARY AND JOHN McCREADIE. University of South Alabama. Vertical stratification of carrion flies (Diptera).

The intent of this study is to determine if either the pattern of succession of a corpse colonization by blow (Calliphoridae) and flesh (Sarcophagidae) flies or the composition of the larval community, differed with distance above ground level. Fresh animal carcasses

(chickens) were used as corpse proxies. The study site was a rural, densely wooded mixed forest woodlot (30° 33' 40. 75" N; 88° 19' 49. 46" W) in Grand Bay, Alabama, USA. Flies were sampled at three different levels (understory, middle and canopy) of four pine trees (*Pinaceae*) for a total of 12 samples per experiment. Experiments were replicated from June 22nd to August 13th 2009 and from September 5th to December 9th 2009, representing summer and fall conditions. Results showed species composition varied both among distance above ground level and between seasons. For example, 10 fly species were collected from summer carcasses with *Neobellieria* (Scarcophagidae) being the dominant genus, whereas 7 species were taken from the fall collections with *Calliphora* (Callophoridae) the dominant genus. Intercept traps were also employed to determine in flies foraged at different levels above ground level or initially started foraging at ground level and followed the presences of corpses up each tree.

O8.11 CHRISTOPHER MOWRY¹, NICOLE ACUFF¹, JOHN LAWRENCE¹ AND RANDAL HALE². Berry College¹, North River Geographic Systems, Inc.². Home range, habitat use and morphology of coyotes (*Canis latrans*) in northwest Georgia.

Coyotes (Canis latrans) are relatively recent immigrants into the southeastern United States. Although actual live sightings of these elusive animals are rare, other forms of evidence (e.g., scat, tracks, howling, pet depredation, road kills) lead many people to believe that their numbers are increasing. In order to learn more about the natural history of coyotes in the southeast, a radio-monitoring project was initiated in 2006 on the 10,825ha Berry College campus in northwest Georgia. The study site consists of a combination of fields, hardwood and pine forests, wetlands, creeks and a lake, although humandominated landscapes are adjacent. Eight coyotes (3 females and 5 males) were captured and weighed/measured, radio-collared and then monitored for an average of 793 days (range 228 - 1,381 days). The minimum convex polygon (MCP) method was used to calculate a mean 95% home range of 2,383 ha and a 50% core-area of 634 ha based on 408 relocation estimates. All core areas were located predominantly in forested habitat. The average weight of captured coyotes was 14.21 kg (range 11.8 - 17.24 kg). Presence of melanistic pelage in this population was noted with the capture of two black coyotes. One of these, a juvenile male, dispersed 41.5 km away from his initial capture site. Four known coyote mortalities occurred during the study, all caused by recreational hunters.

O8.12 NADA HYATT AND JONATHAN STORM. University of South Carolina Upstate. Use of Urban Greenways by Small Mammals.

Loss of native habitat due to urban sprawl is a key contributor to the current decline in species diversity. Urban greenways – linear parklands maintained in a more natural condition than typical urban parks – represent one method by which wildlife might be conserved within urban areas. We sought to determine whether urban greenways in Spartanburg, South Carolina, provide effective habitat for native small mammals. We compared the small mammal community within two riparian urban greenways (the Edwin M. Griffin Reserve and USC Upstate Palmetto Trail) to the community within a rural riparian forest (Peter's Creek Heritage Preserve). We conducted a mark-recapture study during June-August and November of 2009. Within urban greenways, we captured 58 individuals representing 4 species at the Griffin Reserve and 18 individuals representing 2 species at the Palmetto Trail. At Peter's Creek, we captured 23 individuals representing 3 species. Across all sites, the most common species captured were the white-footed mouse (*Peromyscus leucopus*) and southern short-tailed shrew (*Blarina carolinensis*). Following analysis in Program MARK, we will present data on the abundance, density, and survival of *P. leucopus* at each site.

O8.13 M. PATRICK BRANNON, MELISSA A. BURT, DAVID M. BOST, AND MARGUERITE C. CASWELL. Highlands Biological Station, Highlands NC. An examination of shrew species distributions along an elevational gradient in the southern Appalachians using data from discarded bottles.

Discarded bottles were inspected for skeletal remains at 220 roadside sites along the southeastern Blue Ridge escarpment of North Carolina, South Carolina, and Georgia to examine the distributions of regional shrew species. Vertebrate remains were found at approximately 63% of our study sites and in 4.5% of the open bottles we examined. Bottles collected a total of 553 specimens of small mammals representing 5 species of shrews and 6 species of rodents, with an overall capture rate of 9.0%. Overall soricid diversity was positively associated with increased elevation and habitat moisture. The Northern Short-tailed Shrew (Blarina brevicauda) and the Smoky Shrew (Sorex fumeus) were abundant and distributed throughout the region, although Smoky Shrews were more greatly associated with mesic environments and higher altitudes (X = 940.1 m). The Masked Shrew (S. cinereus) and the Southeastern Shrew (S. longirostris) exhibited contiguous allopatry, with Masked Shrews occurring exclusively in mesic forest habitats at high elevations (X = 1,126.7 m) and Southeastern Shrews occurring only in xeric habitats at lower elevations (X = 503.7 m). Given the prevalence of small mammal entrapment, the accumulation of bottles along roadways in the southern Appalachians may pose a potentially serious conservation threat.

O9.1 CHERYL L. SESLER, GEORGE CLINE, CHRIS MURDOCK, AND BENJIE BLAIR. Jacksonville State University. <u>Molecular Identification of Gastrointestinal</u> Bacteria from Adult Cope's Grey Treefrogs (*Hyla chrysoscelis*).

Hyla chrysoscelis, or Cope's Grey Treefrogs, are common in the eastern United States and are not known to be experiencing the population declines observed in many amphibian populations. Anuran metamorphosis is one of the most complex transformations, involving anatomical and physiological changes. Remodeling of the intestinal tract is the most complex event. Tadpoles have simple intestinal organization in comparison to adult frogs. Adult digestive tracts are structurally similar to those of higher organisms. Previous studies have shown that adults feed primarily on insects, while tadpoles filter feed from the water column. The intestines provide a large luminal tract colonized by bacterial symbionts. These bacteria are responsible for proper nutrient assimilation and immune function. The goal of this project is to molecularly identify the bacteria present in the gastrointestinal tract of adult Cope's grey treefrogs. Five adult H. chrysoscelis were collected from a single site in Alabama and euthanized according to AVMA guidelines. Gastrointestinal tracts were removed from each frog and homogenized. A portion of each homogenized tract was used to create a pooled sample. Genomic DNA was extracted and 16S ribosomal DNA genes were amplified using universal eubacterial primers. PCR products were cloned and sequenced. Sequence analysis and phylogenetic construction was performed using MEGA 4.0 software. Preliminary results show most clones had percent identities ranging from 90-95% to sequences in GenBank. Few clones could be identified on the genus level (>97% identity) and included Bacteriodes, Clostridium, and Enterobacter, organisms commonly found in digestive tracts of higher organisms.

O9.2 MEGAN ARRINGTON, JACK SUMMERS, JEFF SCHMITT, JONATHAN MARKLEY, MICHELLE YOST, AND ERIN PARRIS. Western Carolina University. Superoxide Dismutase Inhibitor Screening and Characterization Using ¹⁹F NMR.

Superoxide dismutase enzymes (SOD) catalyze the disproportionation of superoxide to form molecular oxygen and hydrogen peroxide in a cyclic mechanism. SODs prevent the

formation of hydroxyl radicals, preventing apoptosis. Up-regulation of this enzyme implicates it in the survival of cancer cells and pathogenic bacteria, leading to a call for SOD inhibitors as potential drug targets. Huang determined that 2-methoxyestradiol selectively inhibited human SOD, killing leukemia cells while preserving the healthy lymphocytes. Screening for such inhibitors requires SOD activity assays. Traditional assays for SOD activity detect the products of superoxide reactions. Since superoxide reacts with organic functional groups, many compounds from molecular libraries will undergo reaction, giving the appearance of SOD inhibition. Many of these compounds will not inhibit SOD activity; therefore assays that rely on superoxide must be questioned. To overcome this limitation, we use a ¹⁹F NMR based assay that uses fluoride as a superoxide mimic. This assay measures the effect that the SODs have on 19F NMR relaxation of the fluoride anion (F-). Trifluoroacetate (tfa) is relatively insensitive to relaxation by the enzyme and is used as an internal reference. Using F- and tfa, the concentration of active enzyme can be determined from a single transient, 1-dimensional NMR experiment. Using this method, our group has discovered compounds that inhibit CuZnSOD, and have characterized the interactions of these inhibitors with the enzyme.

O9.3 THOMAS E. MEIGS. University of North Carolina Asheville. Dissection of $G\alpha 12$ -mediated Signaling Pathways through Mutational Analysis of Effector Binding.

The heterotrimeric G protein α -subunit G{alpha}12 has been implicated in a variety of cellular responses, including signaling pathways leading to cancerous proliferation and invasion. Efforts to decipher the mechanism of G{alpha}12 action have been complicated by the discovery of more than a dozen putative effector proteins that directly interact with G{alpha}12. Our goal has been to dissect this signaling network using a protein-protein interaction screen, in which various downstream binding partners of G{alpha}12 are engineered as fusions to glutathione-S-transferase (GST) and then assessed for binding to a comprehensive panel of amino acid substitution mutants within G{alpha}12. Thus far, we have engineered and expressed GST-fusions of the proteins radixin, epithelial cadherin, heat shock protein-90, protein phosphatase-5, axin, polycystin-1, Bruton's tyrosine kinase, the scaffolding subunit of protein phosphatase-2A, and several Rhospecific guanine nucleotide exchange factors. We have demonstrated each of these immobilized fusion proteins to precipitate constitutively active G{alpha}12 from human kidney cell lysates. Subsequently, our screening of these fusion proteins for precipitation of G{alpha}12 mutants has revealed several amino acid motifs within G{alpha}12 necessary for effector binding. Of particular interest, we have identified several "selectively uncoupled" mutants that are impaired in binding a specific target protein while retaining normal interaction with other G{alpha}12 effectors. These results set the stage for studies in which these mutants can be used to assess the biological role of G{alpha}12 interaction with specific downstream signaling proteins in cells as well as transgenic organisms.

O9.4 WILLIAM SMOLSKI. University of North Carolina at Asheville. <u>A structure-based</u> analysis of Gα12 interaction with target signaling proteins.

G α 12 is the alpha subunit of the heterotrimeric G protein G12. This protein has been implicated in a number of cellular processes, most notably cytoskeletal rearrangements, cell migration, oncogenic transformation, and metastasis. The overall goal of my research is to identify specific regions within G α 12 necessary for binding its target proteins, and to examine these regions in a three-dimensional structural model of Ga12. My initial experiments have studied the Ga12 interactor protein phosphatase 5 (PP5), which regulates many cellular functions and has been linked to breast cancer progression. A fusion protein of PP5 and glutathione-S-transferase (GST) was immobilized on a chemical matrix, then tested for binding against a comprehensive panel of G α 12 mutants, each mutant having a different small region replaced with an inert sequence of amino acids. Cellular proteins precipitated by PP5 were separated by gel electrophoresis, and these

were probed with a $G\alpha12$ -specific antibody. The amount of each Ga12 mutant that interacted with PP5 was quantified and compared to the non-mutant $G\alpha12$. These studies have identified several regions of Ga12 important in PP5 binding. Recently I extended these studies to another set of Ga12 mutants, designed by a collaborating research group at UNC-Chapel Hill, that consist of single amino acid substitutions. Several of these mutants interact poorly with PP5 in my pilot experiments, and are now being tested for binding to additional Ga12 target proteins to determine the selectivity of this binding impairment. In addition, I have mapped these sites of possible PP5 contact within the predicted Ga12 tertiary structure. These findings should facilitate future work in which Ga12 mutants selectively uncoupled from PP5 can be inserted into living cells in place of native Ga12, in order to study the specific effects of Ga12-PP5 interaction.

O9.5 LIANG YU AND ANNA JENG. Old Dominion University. <u>The Effects of Particulate Matters on Altering Nitric Oxide Bioavailability in Endothelial Cells.</u>

Growing clinical evidences have proven that exposure to ambient particulate matters can cause adverse health effects, especially cardiovascular diseases. However, the biological mechanisms as how inhalation of PMs can potentiate cardiovascular diseases are not yet fully understood. Thus, this research objective is to examine how PMs mediate nitric oxide bioavailability that causes endothelial dysfunction and as a result, initiates atherosclerosis. The hypothesis is that lipid peroxidation induced by ambient PMs alters NO bioavailability. In order to test the hypothesis, this study measures the ROS level of PMs exposure from in vitro experiments, and analyzes the linear regression between MDA and NO level. TBARS is used as a colorimetric method to detect MDA that is expressed in nmol/ml/mg after the adjustment of protein concentration. The colorimetric assay of nitrite (NO2)/ nitrate (NO3) is used to assess NO level in terms of µM/mg. A Bruker 12 Tesla Fourier Transform Ion Cyclotron Resonance Mass Spectrometer (12T-FTICR-MS) is applied to identify the fatty acids and the major phospholipids that are oxidized by PMs. Matlab is used to analyze the atoms (C, H, N, O, S, and P) in negative ion mode after data screening from FTICR-MS. The finding of this research provides new insights into mechanism that underlie the cardiotoxicity effects of PMs. This in turn will further our awareness of health risks from PM exposure.

O9.6 AMANDA SCHOONOVER AND LORI SEISCHAB. Western Carolina University. The effects of diethyldithiocarbamate on *E. coli* growth in the presence of antibiotics.

Diethyldithiocarbamate (DDC) is commonly used *in vivo* to inhibit CuZnSOD by removing the Cu(II) from the active site. We studied the effect of DDC on *E. coli* growth in the presence of three antibiotics. Treatments were added when the cells reached early log phase. Concentrations of DDC up to 10 μ M did not affect the growth rate. The growth rate was decreased by more than 90% with 100 μ M DDC but higher concentrations of DDC diminished this effect. Similarly, when cells were treated with DDC and either ampicillin or kanamycin, *E. coli* growth was completely inhibited with 100 μ M DDC but only moderately inhibited by 1 mM DDC. However, when cells were treated with 100 μ M DDC and norflaxacin, cell growth recovered after 1 hour and then exceeded the growth rate in the presence of 1 mM DDC and norfloxacin. Since log phase cells do not normally synthesize CuZnSOD, these effects of DDC are probably not due to inhibition of CuZnSOD. Interestingly, our observations of diminished effects at higher concentrations of DDC correlate to studies of the cytocidal effects of DDC-copper chelates.

O9.7 DONALD PATTERSON AND CHRISTOPHER COBURN. Western Carolina University. <u>Using a Catalytic Beacon to Identify Effective siRNA Target Sites.</u>

Small double-stranded RNA molecules can induce sequence-specific post-transcriptional gene silencing in eukaryotic cells. The mechanism by which this occurs is referred to as RNA interference (RNAi). RNAi is triggered by the introduction of double-stranded short interfering RNAs (siRNAs, 20-22 nucleotides long) into the cell. The siRNA assembles with proteins to form an active RNA-induced silencing complex (RISC). Once formed, RISC is directed to a site within the target mRNA complementary to one strand of the siRNA. For an siRNA to be effective, its complementary site within the target mRNA must be accessible to the RISC complex. Indeed, the primary obstacle to developing a successful RNAi strategy is finding an accessible site within the 3-dimensional structure of the target mRNA. We believe a catalytic beacon could be used to experimentally verify the accessibility of putative target sites before undertaking the costly and time consuming siRNA trials. Toward this end, we have begun experimenting with an inexpensive catalytic beacon capable of selectively detecting unpaired RNA sequences 20-22 nucleotides long.

O9.8 LACY DANIKAS AND VINCENT COBB. Middle Tennessee State University. Latitudinal variation in thermal physiology of the northern watersnake, *Nerodia sipedon*.

Locomotor performance is arguably one of the most important physiological mechanisms for capturing prey and avoiding predation, and, is thereby generally subject to pressures of natural selection. For ectothermic animals, locomotor performance varies considerably with temperature. Locomotor performance typically increases with temperature, reaching an "optimal" or maximal efficiency level before declining as the critical thermal maxima is approached. Across a broad geographic range with considerable climate variation, the thermal physiology of ectothermic species could vary in a predictable pattern. The northern watersnake is one of the most wide ranging snake species in North America, and is exposed to a wide range of environmental conditions, making it a good model species to test adaptation to regional conditions. We examined the effect of temperature on locomotor performance (maximal crawling and swimming speeds) from two latitudes representing the northern and southern localities for this species. Maximal crawling and swimming speed differed significantly between the two populations, with the southern population exhibiting optimal terrestrial locomotor performance at a temperature 5° higher than that of the northern population. Aquatic trials exhibit similar curves for both northern and southern populations, however performance differed significantly. Optimal temperatures varied between latitudes only for terrestrial tests, which may suggest differences in habitat use by populations. This pattern of separation between the two populations indicates possible thermal adaptation to regional climatic conditions by ectotherms and could potentially influence selective pressures.

O9.9 MATTHEW KLUKOWSKI. Middle Tennessee State University. <u>Effects of breeding season, testosterone and ACTH on the corticosterone response of freeliving male fence lizards (Sceloporus undulatus)</u>.

An attenuated stress response during the breeding season has been reported for several vertebrate species, but the underlying physiological mechanism has received little attention, particularly in reptiles. Modulation could involve changes in the capacity of the adrenal gland to secrete glucocorticoids in addition to upstream changes in the pituitary or hypothalamus. Here I tested whether adult male Eastern Fence Lizards, *Sceloporus undulatus*, have a weakened corticosterone response to capture and confinement in the breeding season relative to the nonbreeding season by capturing males in both seasons and subjecting them to the identical stressor of four hours of confinement. Plasma corticosterone levels in response to confinement were significantly lower in the breeding than the nonbreeding season. Second I tested for an effect of testosterone on the stress response by experimentally elevating plasma testosterone levels via silastic implants in free-living males during the nonbreeding season. Males with experimentally elevated

testosterone exhibited significantly weaker corticosterone responses to one hour of confinement than sham-implanted males. Third I tested the capacity of the adrenal glands to secrete corticosterone during the breeding season by challenging males with adrenocorticotropin (ACTH) injections. In spite of naturally suppressed corticosterone responses during the breeding season, males nonetheless responded robustly to ACTH. Altogether these results suggest that modulation resides upstream of the adrenal gland, as has been shown in some arctic-breeding avian species, and likely involves seasonal changes in testosterone levels. Ongoing work is examining the role of ACTH releasing factors as well as the functional significance of adrenocortical modulation.

O9.10 MAYUR FAGWANI AND CHRIS R. GISSENDANNER. Department of Biology, University of Louisiana at Monroe. <u>Investigation of G1/S regulation by the NHR-6 nuclear receptor transcription factor in *C. elegans*.</u>

NR4A nuclear receptors regulate cell proliferation and cell differentiation during normal development and in several human diseases. We are studying the NR4A homolog, NHR-6, in the genetic model organism C. elegans. NHR-6 has previously been shown to be required for cell proliferation during organogenesis of the spermatheca and we are using this model system to investigate the genetic mechanisms by which NR4A nuclear receptors regulate cell proliferation. The cell cycle consists of four phases: G1, S, G2 and M. We hypothesize that NHR-6 directly promotes G1/S phase progression by regulating the expression or activity of proteins involved in G1/S progression. To test this hypothesis, a time lapse experiment on the G1/S entry of the spermatheca precursor cells (SPC's) in both the wild type and the nhr-6 mutant background is being conducted using cell cycle markers. There are two major possible mechanisms for NHR-6 regulation of G1/S. First, NHR-6 could be positively regulating genes or proteins that promote G1/S entry, such as cyclins or cyclin-dependent kinases. Second, NHR-6 could be negatively regulating genes or proteins that inhibit G/S progression, such as cyclin kinase inhibitors. To test if NHR-6 has any of these functions we are addressing the expression of both positive and negative regulators of G1/S in an nhr-6 mutant background. In addition, we are also constructing double-mutants of *nhr-6* with genes encoding negative G1/S regulators, with the prediction that loss of function of these negative regulators should suppress the nhr-6 cell proliferation phenotype if NHR-6 promotes G1/S progression.

O9.11 JENNIFER KELLY, BENJIE BLAIR, MARK MEADE AND CHRIS MURDOCK. Jacksonville State University. <u>The effects of Eubacterium cellulosolvens 5494, a possible probiont, on growth rates in Oreochromis niloticus.</u>

The use of probiotics has been shown to reduce infection and mortality, while increasing growth rates in aquaculture species. Most of these aforementioned studies have utilized facultative anaerobes. In this study, the effects of Eubacterium cellulosolvens 5494, a gram positive, cellulolytic, strict anaerobe isolated from bovine rumen was addressed as a potential probiont. This bacterium has been shown to efficiently degrade cellulose, which is frequently used as filler in commercial fish feed. Commercial feed was supplemented with E. cellulosolvens and presented to Oreochromis niloticus fry on three separate occasions over the course of the first 10 days of the experiment. O. niloticus fry were maintained in 37.8 L tanks (at a density of 25 fish per tank) for a total of 45 days. Fish that received the E. cellulosolvens supplemented feed were significantly (P < 0.1) larger (3.66g + 0.29g; n = 75) than the control fish (2.76g + 0.51g; n = 75). Liver tissue samples were also collected from these fish for comparisons of insulin-like growth factor 1 (IGF-1) expression patterns, using quantitative real-time PCR methodology, in response to probiotic treatments. IGF-1 is an important hormone within the somatotropic axis and is essential for stimulating maximal growth. These data may help establish links between growth, molecular mechanisms of growth signals and anaerobic, cellulolytic bacteria in the digestive tracts of aquaculture species.

O9.12 ERIKA BALOGH, J.M. HERR, JR., MIHÀLY CZAKÓ, AND LÀSZLÓ MÀRTON. University of South Carolina. <u>Defective development of male and female gametophytes in Arundo donax L.</u>

Arundo donax L. displays rare or perhaps unique physiological features whereby the plants readily absorb and concentrate toxic chemicals from contaminated soil with no appreciable harm to their own growth and development. This species, therefore, provides a useful tool for removal of toxic chemicals near industrial sites. However, the invasive nature of the plant has led to its rejection for this use largely out of fear of its spread by seed to adjacent natural areas where rapid vegetative growth would greatly alter if not totally destroy natural populations. The investigation reported here clearly shows that Arundo donax does not produce pollen or viable seed. Approximately 10% of the ovaries enlarge and take on the character of mature caryopses. The single anatropous, bitegmic ovule within the enlarged caryopsis, contains a massive crassinucellate nucellus the cells of which are of uniform size. The occasional archesporial cell fails to produce a megasporocyte. Enlarged caryopses placed in several standard germination environments failed to produce new plants thus to assure that enlarged ovules do not function as vegetative propagules. The spread of Arundo donax beyond the margins of the contaminated plots could occur only by rhizomatous growth, which by the application of simple precautions could be impeded. Spreading could be prevented by simple precautions such as 50-100 ft buffer zones from temporary or permanent streams and rivers.

O10.1 JACOB HILTON¹, WADE WALL², THOMAS WENTWORTH², JANET GRAY³, MATTHEW HOHMANN⁴, AND WILLIAM HOFFMANN². Coastal Sciences Department, University of Southern Mississippi¹, Department of Plant Biology, North Carolina State University, Raleigh, NC 27695², Endangered Species Branch, Fort Bragg, North Carolina³, US Army Corps of Engineers, Construction Engineering Research Laboratory⁴. Effects of light and temperature on Pyxidanthera barbulata var. brevifolia germination.

Pyxidanthera barbulata var. brevifolia is an evergreen semi-woody cushion plant endemic to the Sandhills of North and South Carolina, with the majority of populations occurring on Fort Bragg Military Reservation of NC. Currently the taxon is listed as vulnerable to extinction in North Carolina and is designated by the US Department of Defense as a Species at Risk (SAR). Previous studies suggest that seeds may not be viable because they fail to germinate under controlled conditions. Our aims were to successfully germinate P. barbulata var. brevifolia seeds, determine the best temperature conditions for germination, and understand more about the germination strategies to aid in future restoration efforts. We germinated seeds under six treatments, all combinations of three temperature regimes (low (18/14°C day/night), medium (22/18°C), and high (26/22°C)) and two light conditions (dark and light). In contrast to previous findings, we determined that P. barbulata var. brevifolia does produce viable seeds, and that there are significant effects of light and temperature on germination. The highest germination proportions were under low temperature and high light conditions (78%), while high temperature and high light conditions produced the lowest germination rates (6%). Light-exposed seeds also germinated significantly earlier in the cooler temperature, compared to medium and high temperatures. These results indicate that it is possible to successfully germinate seeds of this rare plant, while providing information on its regeneration niche. Specifically, seedling establishment of this taxon likely occurs in late fall and appears dependent on adequate light availability to break dormancy.

O10.2 KRISTIE S WENDELBERGER¹, JOYCE MASCHINSKI², ALAN WEAKLEY¹, PETER WHITE¹. University of North Carolina¹, Fairchild Tropical Botanic Garden². <u>Using an experimental technique to determine microsite preference</u> when introducing endangered species.

As habitat is lost to development and/or altered through climate change, biodiversity around the world is increasingly threatened leading land managers to turn to introductions as a means of preventing rare species extinctions. We used the introduction of the Florida state rare plant, Tephrosia angustissima var. corallicola (Coral hoary pea), as an example of how one can experimentally introduce a species helping to increase the chances of success. We designed this experimental introduction with three goals in mind: create a viable population of this rare species, determine the species' specific microsite requirements, and test whether or not using an experimental approach in our design would increase the chances of creating a viable population. Because little was known about the microsite requirements of T. angustissima var. corallicola, we monitored demographic patterns of a clone subset of the wild population and over 3,000 seedlings in three different microsites within its native pine rockland habitat: Open canopy dominated by Serenoa repens (Saw palmetto), closed canopy dominated by Pinus elliottii var. densa (Dade-County slash pine), and along a firebreak edging the pine rockland. With long-term data (2003-2009) we were able to determine the best microsite within the pine rocklands to introduce this species into, time from germination to reproduction, and best season for introduction and germination to ensure greatest survival. Insights into the species' biology and life history gained from this experimental introduction can now be used to introduce more populations of the species with greater confidence in its survival.

O10.3 MATT PARDUE AND KIM MARIE TOLSON. Department of Biology, College of Arts and Sciences, University of Louisiana at Monroe, Monroe, LA 71209-0520. Prairie restoration efforts in northeast Louisiana to benefit grassland birds.

Only about 600 acres of native prairie remain in Louisiana with most of the remnants located in the southern portion of the state. Coastal prairie once comprised between two and three million acres. However, prairies could also once be found throughout scattered localities in north Louisiana. These prairies were known as "pocket prairies" due to their small size and general isolation from similar biomes. Dominant grasses within these communities include Andropogon gerardii, Schizacharium scoparium, Sorghastrum nutans, and Tripsacum dactyloides. Many birds rely on these prairie ecosystems during their life cycle for feeding, cover, nesting, and brood-rearing. Grassland birds have seen some of the sharpest declines of bird species throughout North America. The Louisiana Department of Wildlife and Fisheries recognized a site of ~ 110 acres within Ouachita Wildlife Management Area as suitable for prairie restoration. This site is reclaimed agricultural land that was previously used for rice and corn production, and has seen multiple reforestation efforts fail. Prairie restoration efforts were initiated in the fall of 2007 in a cooperative agreement between ULM and LDWF. A comprehensive list of avian species utilizing the site, the restoration strategies employed, as well as the status of restoration efforts will be presented.

O10.4 JOHNNY RANDALL AND MIKE KUNZ. North Carolina Botanical Garden, University of North Carolina at Chapel Hill. Reintroduction of *Ptilimnium nodosum* to the Deep River, NC (Apiaceae).

Ptilimnium nodosum (Harperella), a federally listed taxon, currently occurs in only one location in NC and is declining across its range. We reintroduced individuals to a historical site on the Deep River, NC, from plants derived from the reintroduction site. Because it is particularly challenging to reintroduce an emergent aquatic plant that occupies the uncertain habitat of riverine gravel bars, we tested the efficacy of using streambed

stabilization treatments in comparison to planting in natural cobble. Of the 630 original plants planted in 2006, approximately 130 individuals remain. Such dramatic attrition of the original planting was anticipated because of frequent flooding, herbivory, and natural mortality. We are optimistic that our reintroduction will be successful given the number of established individuals that show both sexual and vegetative reproduction.

O10.5 MICHAEL KUNZ¹, JOHNNY RANDALL¹ and MISTY BUCHANAN². North Carolina Botanical Garden, University of North Carolina at Chapel Hill¹, North Carolina Natural Heritage Program². <u>Translocation of the federally endangered Lysimachia asperulifolia</u> (Myrsinaceae).

Lysimachia asperulifolia (Rough-leaved Loostrife) is a federally endangered, rhizomatous, perennial herb endemic to pocosins and pocosin ecotones in the coastal plain of North and South Carolina. We collected rhizomes in the dormant and growing seasons of 2003 from a portion of a population slated for destruction. In two different protected sites, individual rhizomes were transplanted into plots pretreated either with mowing or herbicide to remove vegetation, or into plots with no pretreatment. Plots planted with rhizomes dug in the growing season and receiving no pretreatment have shown an overall decline in the number of individuals. However, the pretreated plots and plots planted with dormant season dug rhizomes have all shown an overall increase in the number of individuals. Although translocation projects must be monitored for many years, we found dormant season removal of rhizomes and decreasing competition from surrounding vegetation important factors for potential success in the translocation *L. asperulifolia*.

O10.6 KEITH HOFFMAN AND LAURA DeWALD. Western Carolina University. <u>Patterns of Recruitment and Culm Morphology in Arundinaria gigantea</u> ([Walt.] Muhl.)

Canebrakes in Western North Carolin. River cane is one of three bamboos native to North America. As with many other bamboos it has been an integral component in the culture of native peoples. River cane was once ubiquitous across the southeastern US but now has been reduced to less than two percent of its original coverage. This study is among the research efforts focused on restoration of river cane to revitalize traditional artisan crafts, restore a native species, and protect riparian habitats. The purpose of our project was to describe patterns of recruitment of river cane within existing canebrakes, and to determine if these patterns were related to culm morphology. Four large canebrakes in western North Carolina were intensively sampled by establishing 1 m² plots every 3 m along transects that were 3 m apart across the entirety of each canebrakes. All culms were counted within each plot with culms being identified as immature (newly recruited) or mature. Culm diameter, branch free height, and total height measured for all immature culms. Arc GIS was used to create visual representations of morphological and density changes through the canebrake, and regression analyses were used to determine if immature culm density and morphology were related to distance from the edges of the canebrakes. This presentation will describe these relationships, and will discuss the implications of these relationships to the restoration of these ecosystems and the production of high quality of river cane for artisan use.

O10.7 CHRISTINE SMALL¹, MATT BRENNAN¹ AND JIM CHAMBERLAIN². Radford University¹, USDA Forest Service². Experimental harvesting effects on black cohosh (*Actaea racemosa*), a southern Appalachian medicinal plant.

Black cohosh (*Actaea racemosa*) is a native southern Appalachian deciduous forest herb, widely harvested for hormone-replacement therapies and treatment of menopausal symptoms. Yet >95% of cohosh is harvested from wild populations, with little monitoring of harvesting levels or impacts. To better understand harvesting effects and plant recovery, naturally-occurring cohosh populations were monitored from 2005-2008 in two replicate

study sites in the George Washington-Jefferson National Forest of western Virginia. At each site, 72 - 2 x 5 m plots were established and plants subjected to one of three harvest treatments (0%, 33%, or 66%). Tree canopy cover was negatively correlated with mean cohosh height (r = -0.33; p = 0.02) and ground coverage (r = -0.37; p = 0.01). Intensive harvesting produced severe reductions in nearly all measures relative to 2005 surveys, including reductions in ground coverage (0% vs. 66% harvest = 0.65 vs. -2.26 m²; Kruskal-Wallis $X^2 = 15.8$; p < 0.001), maximum plant height (-16.0 vs. -37.9 cm; ANOVA F = 4.12; p = 0.03), and number of stems (1.0 vs. -6.6; $X^2 = 7.3$; p = 0.03). Our results suggest that intense harvesting (comparable to our 66% harvest) may not be sustainable for native populations, particularly under deeply shaded conditions. With rising demand for black cohosh, it is increasingly important to assess the sustainability of current wild-harvesting practices and establish viable management strategies.

O10.8 DIANA M. NEAL¹, RACHEL JOLLEY¹, BRIAN BALDWIN¹, GARY ERVIN¹, MARGARET CERTAIN², JOHN SEYMOUR³, AND JULIAN CAMPBELL³. Mississippi State University¹, University of South Carolina², Bluegrass Woodland Restoration Center³. Maximizing seed germination methods to enhance Rivercane [Arundinaria gigantea L. (Walter) Muhl] seedling production for habitat restoration programs.

Large areas of rivercane, known as canebrakes, once occurred throughout alluvial floodplains in the southeastern United States. However, today it is estimated that canebrakes occupy less that 2% of their original habitat and are now considered critically endangered ecosystems. Canebrakes provide exceptional wildlife habitat, promote streambank stabilization, and improve water quality, making it an ideal species for riparian restoration projects. However, plant material from seed is limited due to infrequent flowering events, low seed viability, the recalcitrant nature of seed, and low seed production from flowering stands. The purpose of this study is to maximize seed germination procedures to increase production of rivercane seedlings available for habitat restoration programs. This study compares germination rates across various storage treatments (storage in sealed and open plastic bags, paper bags, and moist and dry stratification at -5°C, 5°C, and room temperature), germination treatments (roll towels method in light and dark, seed with/without lemma and palea). Seed germination were also test to fungicide exposure (with/without) and weight differences (light, medium and heavy) of clean seed. Seed germination had the highest success when stored in moist conditions or in sealed bags at -5°C and 5°C (with a germination range of 0-40%). Seed with lemma and palea intact, and heavy seed had significantly higher germination rates than other treatments. No significant differences were observed on roll towels and fungicide germination treatments. With the continuation of this study, we expect to find the best method of maintaining seed viability and best germination methods to assure seed germination.

O10.9 M. LEIGH NELSON¹ AND JENNIFER RHODE WARD². New College Florida¹, University of North Carolina Asheville ². <u>Variation in reproductive effort among morphotypes in a hybrid plant complex.</u>

The quantity and quality of pollen and ovules produced by plants reflects their energetic expenditure to breeding, or reproductive effort. This study examined how reproductive effort varied among three morphotypes (northern parents, southern parents, and their late-generation hybrids) in the *Piriqueta cistoides caroliniana* plant complex. Hybrid morphotypes in this distylous group exhibit heterosis, with superior growth and survival, so hybrids were expected to produce more gametes than parental lineages. Samples from 1400 *Piriqueta* individuals (28 populations) were collected from throughout their native range in 2008 and 2009, and floral parts were removed and preserved in 70% ethanol. To quantify reproductive effort, ovaries were dissected to count ovules, and pollen grains

were counted with a hemocytometer. Analyses indicated a significant effect of morphotype on pollen and ovule quantities. In addition, style morphology had a significant effect on pollen quantity but not ovule numbers. Pollen:ovule ratios did not differ among morphotypes or morphs, suggesting intrinsic control of resource allocation. Future study will focus on separating the effects of genotype versus environment on reproductive effort.

O10.10 RYAN B. HOMSHER AND BRIAN C. MCCARTHY. Ohio University. <u>Above ground resource allocation of southeastern Ohio oaks</u>.

Silvicultural practices are a significant disturbance in a forest ecosystem. How oak trees allocate resources in response to these disturbances is not well documented. Additionally, it is not universally recognized if individual genetics or the local environment dictates how a tree will perform in an ecosystem. Basal area increments, seed production and branch length was measured in two experimental forests in southeast Ohio. Each forest was divided into four, 20-ha silvicultural treatments: Thinning (fire surrogate), thinning and prescribed burning, and prescribed burning and an untreated control. Five Chestnut oaks (Quercus prinus) and five Black oaks (Quercus velutina) were selected from each treatment and control. Primary growth was measured by collecting branches from the outer canopy of each oak tree at the end of the 2009 growing season with a .22 LR rifle. Branch length collections were limited to 2002 or what could be harvested from oak study trees. Secondary growth was measured via basal area increments calculated from tree rings cored from oaks under study. The cores were only measured back to 2001. Oak seed production was measured from August to December by collecting acorns via two, .25 m² seed traps at the canopy line of each oak tree. Oak seed production has been monitored since 2001. Thinning treatments resulted in increased secondary growth in Black oak trees (Kruskal-Wallis chi-squared = 20.47, df = 3, p-value = 0.0001). This research indicates Chestnut and Black oak seed production patterns may be more tightly controlled by individual tree genetics than environmental conditions.

O10.11 HEATHER E. TRAN, LARA SOUZA, AND AIMEE T. CLASSEN. University of Tennessee. Intra-specific variation in phenology and its effect on fitness.

Flowering length has been shown to influence fitness both across and within plant species across populations. However, little is known about the potential fitness consequences of genotype shaping flowering dynamics, as opposed to the environment shaping flowering dynamics. In our study, we asked: 1) Does intra-specific variation influence flowering dynamics and fitness?, and 2) Can we predict intra-specific variation in fitness using flowering dynamics? We collected 15 Solidago altissima genotypes from northern populations (Connecticut) and 20 Solidago altissima genotypes from southern populations (Tennessee) and placed them in a common garden environment in Tennessee. We tracked phenology of Connecticut (CT) and Tennessee (TN) genotypes by recording the first day of flowering and flowering duration. We also quantified genotype fitness by collecting inflorescence mass. We found that CT genotypes produced flowers approximately 40 days prior to TN genotypes (F = 8.58, P = 0.01), but CT genotypes did not flower for significantly longer when compared to TN genotypes (F = 0.67, P = 0.42). We found that intra-specific variation in first day of flowering can be used to predict fitness (R²= 0.30), but intra-specific variation in the duration of flowering cannot predict fitness $(R^2 = 0.16)$. Our findings indicate that intra-specific variation in flowering dynamics, such as the first day of flowering, can shape fitness of a dominant old-field plant species.

O10.12 CLAUDIA L. JOLLS, MEAGHAN D. CUTCHIN AND THOMAS FINK. East Carolina University. <u>Hedging our bets: in search of heterocarpy in *Packera tomentosa*.</u>

Heterocarpy or heterospermy, different forms of seeds on the same plant, is hypothesized to be a form of evolutionary bet-hedging in response to unpredictable environments. Different seed morphologies and behaviors are common in members of the Asteraceae. particularly between disk and ray achenes and specifically in the genus Senecio. We have begun investigation into the possibility of heterocarpy in woolly ragwort, Packera tomentosa (Michaux) C. Jeffrey (Senecio tomensosus Michaux), a common springflowering perennial of sandy or shallow soils above granite outcrops in the southeastern US. Preliminary analyses present no significant differences in seed mass of disk and ray achenes, averaging approximately 0.29 mg ($F_{1.61} = 0.28$, p = 0.60), although our inferences are limited by small sample sizes. Electron and autofluorescent microscopy of cypselae did not show any distinctive morphologies between the inner and outer fruits, however, the species does have rows of trichomes and a pappus on the fruit typical of the heterocarpic congeners. Germination success of 7-17 mo old lab-stored fruit has been too poor to allow comparison of behavior between inner and outer achenes (2%, 25/15 °C 16/8 hr thermo- and photoperiod). Since reports of heterocarpy in Senecio in the 1980s, molecular analyses of phylogenies of this most speciose genus have placed Packera more closely allied to the genus *Emilia* rather than the heterocarpic members of *Senecio* sensu stricto (s.s.). Nonetheless, there is as yet no reason to eliminate the possibility that heterocarpy may occur in Packera tomentosa.

O11.1 CALEB D. MCMAHAN¹, JASON S. BROACH², AND KYLE R. PILLER¹. Department of Biological Sciences, Southeastern Louisiana University¹, School of Forest Resources & Conservation-Fisheries and Aquatic Sciences, University of Florida². Mullet Mayhem: <u>A taxonomic and systematic review of Southeastern US Mullets</u>.

Mullets (Family Mugilidae) represent a group of fishes found in all temperate and tropical oceans worldwide. The family currently includes about 17 genera and approximately 72 species. Although the monophyly and taxonomic validity of the family is largely uncontested, this family represents a remarkably understudied group of fishes, despite its economic and ecological importance throughout the world. Much of the difficulty in studying this group is due to the fact that morphological variation within the family is relatively conserved and recovering an accurate understanding of species diversity and phylogenetic relationships has long been troublesome. However, in other studies, the inclusion of molecular data has proven to be beneficial for investigating these types of questions. The objective of this presentation is to review the diversity of mullets with an emphasis on species of the Southeastern United States. The taxonomic and systematic history of the family will be reviewed and the results from several ongoing projects will be discussed.

O11.2 SIRISHA BETHALA, JAMIE MCDANIEL; JIANGQUAN ZHU; MAHMOUD HAYTHAM ALAMI; JANET GASTON; AND NEIL BILLINGTON. Troy University. Population genetic variation in sauger and walleye.

Sauger (*Sander canadensis*) and walleye (*S. vitreus*) are large predatory, North American percid fishes that are popular with anglers. Both species are heavily managed by fisheries agencies so information on their population genetic structure will be useful in their management. Genetic variation was screened by cellulose acetate gel electrophoresis in 1023 sauger from 12 populations and 1270 walleye from 13 populations. Two polymorphic loci were surveyed in sauger, esterase (*EST** with five alleles: *60, *85, *100, *105, and *125) and super oxide dismutase (*SOD-2** with two alleles: *100 and *130), while three polymorphic loci were surveyed in walleye, esterase (*EST** with three alleles: *100, *105, and *115), malate dehydrogenase (*mMDH-3** with three alleles: *70, *100, and *120), and general muscle protein (*PROT-3** with two alleles: *100 and *160). Highly significant among population heterogeneity was found for sauger at both *EST** and *SOD-2**. Highly

significant among population heterogeneity was found for walleye at *EST**, *mMDH-3**, and *PROT-3**. Several populations showed significant deviations from Hardy-Weinberg expectations for *mMDH-3**, and *PROT-3**, all of which were due to heterozygote deficits. Such deviations were likely due to the Wahlund effect, because samples were mostly collected during the summer or fall, when sauger and walleye are highly mobile, rather than during their spring spawning period when they exhibit philopatry. Sauger and walleye populations are that are genetically distinct likely exhibit local adaptations, so fisheries managers are encouraged to manage these populations separately, and avoid stock transfers among them.

O11.3 GEORGE R. CLINE, JAMES R. RAYBURN, FRANK A. ROMANO III, KELLY D. GREGG, AND ROBERT E. CARTER Jr., Jacksonville State University. <u>Analysis of Fish Communities: Results from Student Observations.</u>

In May 2008, 16 students and 4 faculty took an extended field trip from the Florida panhandle to the Florida Keys. Over the course of 9 days, faculty and students conducted snorkel surveys for aquatic organisms at 11 sites. These sites included 2 freshwater, 4 estuarine, and 5 marine habitats. Habitats surveyed ranged from freshwater springs, a mangrove swamp, natural reefs, and various anthropogenic marine habitats. Prior to the field trip, students worked on species identification, practiced snorkeling skills, and learned the survey protocols developed by the Reef Environmental Education Foundation (REEF). Students recorded 109 species of fish in their surveys. Species richness ranged from 3-55 species per site. The 5 marine habitats had the greatest diversity (25-55 sp). Estuarine sites had more variable species compositions (3-10 sp), while freshwater sites had 5 and 7 species. The vast majority of species were recorded at 1 site (47 sp.), while only 4 species were found at 6 or 7 sites (2 species each). Multivariate analyses were conducted to look for patterns in fish communities.

O11.4 SHANNON WHITE¹, JOSH HARRIS¹, CHARLES GOWAN¹, AND KURT FAUSCH². Randolph-Macon College¹, Colorado State University². Demographic responses of trout populations two decades after habitat manipulation in five Colorado streams.

Habitat manipulation is used in management of trout streams, despite conflicting evidence as to its long-term efficacy for increasing fish populations. We evaluated efficacy of one type of habitat enhancement, log-drop structures, more than 20 years after initial installation. We quantified longevity of unmaintained structures, effects of structures on physical habitat, and effects of structures on juvenile and adult trout abundance. Log drops were installed in a randomly-selected half of a 500-m study reach in six Colorado streams in 1987 and 1988, and habitat and fish abundance were measured annually through 1994. In 2009, we resampled five of the streams. Results from 2009 match closely with those obtained between 1988 and 1994. All 53 logs installed in the study streams in 1988 were relocated in 2009, and all but two were functioning normally. Moreover, their effects on habitat in 2009 were consistent with results found in 1988-1994: mean and total pool volume were higher in treatment sections than adjacent controls, but mean depth, mean width, and percentage of fine substrate were not. Similarly, abundance of adult (but not juvenile) trout remained higher in treatment sections. Our research shows that log drops can continue to increase trout abundance decades after installation and may not be as dependent on maintenance as previously thought.

O11.5 REBECCA E. HALE¹ AND JOSEPH TRAVIS². University of North Carolina Asheville¹. Florida State University². <u>Lack of abiotic effect supports hypothesis that differences in life histories of least killifish, *Heterandria formosa*, are due to local adaptation.</u>

Least killifish is a placental Poeciliid found in both hard water springs and tannic ponds in northern Florida. Consistently, populations found in springs have higher densities and females in springs are smaller and have fewer, larger offspring than those from ponds. Water hardness is known to affect metabolic rates in fish, therefore, differences in growth and reproductive investment between populations could be driven by the effects of water chemistry on the fish's physiology. Our goals were to examine the effects of spring versus pond water on metabolic rates and life history traits. Although water type did affect metabolic rates and juvenile survival, population differences in reproductive traits persisted across water types.

O11.6 MARK MEADE, GREG SCULL, and JOSH TURNER. Jacksonville State University. Fish assemblages in Choccolocco Creek and its tributaries, Calhoun County AL.

The Coosa River occurs within the Alabama Valley and Ridge physiographic region. The Coosa watershed is considered the largest and most biodiverse subwatershed of the Mobile River Basin and contains a large number of endangered fish, mussel and snail species. A subwatershed of the Coosa, Choccolocco Creek is hypothesized to support the largest number of endangered and threatened species found in any Alabama waterway of comparable size. With regard to fishes, about 70 species total and at least four threatened and endangered fish species occur along the entirety of the Choccolocco Creek drainage. Fish assemblages in the upper and middle regions of Choccolocco creek, including several tributaries, were surveyed using seining and/or backpack electroshocking techniques. A total of 28 fish species were observed with nearly 50% of those being darter and minnow species. At several sites, a federally endangered minnow, the Blue shiner (Cyprinella caerulea), was observed. Where found, Blue shiners accounted for approximately 13% of the total fishes observed. Another state-threatened species, the Coldwater darter (Etheostoma ditrema) was observed. When found, Coldwater darters comprised about 2% of total fishes observed. Although diverse, as with many Alabama waterways, fish assemblages in Choccolocco creek may be impacted by the presence of impoundments. Nonetheless, fish assemblages in the upper regions of Choccolocco Creek represent the many common species found in this mountainous region of the state.

O11.7 KATELYN B. SHANK AND WERNER WIELAND. Dept. of Biological Sciences, Univ. of Mary Washington. A <u>preliminary survey of the fishes of the upper Rappahannock River, VA post dam removal.</u>

Removal of Embrey Dam on the Rappahannock River at Fredericksburg, Va. as a barrier to fish passage was begun in February 2004. During the summer of 2009 we began a survey to ascertain to what extent dam removal had resulted in successful spawning of American shad, *Alosa sapidissima*, in the Rappahannock and Rapidan rivers upstream of the City of Fredericksburg. In April 2009 Virginia Dept. of Game and Inland Fisheries biologists captured eight adult American shad approximately 28 river miles upstream of the former Embrey Dam site. One of these was a wild six year old male, presumably naturally spawned below the dam in 2002. We sampled using snorkeling, seines, and a backpack electrofisher. No shad were observed during our collections. One newly transformed adult sea lamprey (*Petromyzon marinus*, ~ 170 mm) was taken in a tributary of the upper Rappahannock River. This species had not been previously reported from this portion of the Rappahannock River. Information on the distribution and relative abundance of species is reported.

O11.8 GREGORY SCULL, JONATHAN ADAMS, MARK MEADE AND JOSHUA TURNER. Jacksonville State University. <u>An Index of Biotic Integrity for the Shoal Creek Drainage, Calhoun and Cleburne Counties, Alabama, utilizing Fish Assemblage Assessment.</u>

The Shoal Creek drainage is unique in that it is for the most part contained within public lands managed by the Shoal Creek Ranger District, Talladega National Forest, Alabama. The landscape of this forest is rapidly changing as controlled burns and the restoration of the longleaf pine (Pinus palustris) reshape the forest to described presettlement conditions. In cooperation with the United States Department of Agriculture, Forest Service and the Alabama Department of Natural Resources monitoring of this drainage occurred during the timeframe of August 2008 thru September 2009. During this study a total of 4,310 fish representing 8 families, 18 genera and 30 species were captured in 36 sampling attempts at 26 sites. Based upon these results an Index of Biotic Integrity (IBI) was calculated for all 26 sites with scores ranging from no fish to good based solely upon encountered fish assemblages. Higher order sampling reaches which typically are the focus of most assessments of biotic integrity utilizing fish suggest that overall the Shoal Creek drainage is generally of good quality. As sampling proceeded upstream toward the headwaters, IBI scores and overall diversity tended to decrease suggesting that lower order stream segments in this drainage provide poor habitat for most fish species. Presented here are the results of our sampling efforts within the Shoal Creek drainage, upper Choccolocco Creek basin.

O11.9 NICHOLAS COOKSON¹ AND MARK S. SCHORR². City of Chattanooga, Department of Public Works, Stormwater Management Section¹, University of Tennessee at Chattanooga, Department of Biological and Environmental Sciences². Correlations of watershed housing density with environmental conditions and fish assemblages in a Tennessee Ridge and Valley stream.

We examined relationships of watershed housing density with instream environmental conditions and fish assemblage attributes in Mountain Creek, a third-order Ridge and Valley stream in Hamilton County, Tennessee (Chattanooga area). Habitat features and fish assemblages were sampled in May-June 2005 at seven sites (drainage areas <17 km²) in the middle-upper reaches of the Mountain Creek system (Tennessee River drainage). Watershed housing density upstream of the sites ranged from 49 housing units/km² to 72 housing units/km². Twenty-two fish species and 3,686 individuals were found at the seven sites. Native species richness per catchment area ranged from 1 species/km² to 6 species/km² at the individual sites. Index of biotic integrity (IBI) ratings varied from poor to fair/good. Housing density was directly correlated with stream temperature, variation in discharge, fine sediment depth, and abundances of introduced and tolerant species; it was inversely correlated with dissolved oxygen, pH, variation in depth, substrate diversity, and native species richness. Although pockets in upper Mountain Creek appeared moderately healthy, most reaches exhibited signs of degradation. Catchments with > 60 housing units per km² (four of seven sites) received IBI ratings of poor or poor/fair. Our results underscore the negative effects of residential development on water quality, hydrology, habitat complexity, and fish assemblages in a suburban stream.

O11.10 CHISOM J. ONYEUKU¹, J. EVAN MUSSELWHITE¹, SANDRA K. WHEELER², AND DENNIS C. HANEY¹. Departments of Biology¹ and Chemistry², Furman University. Investigating the chemical effects of historical cotton farming on bacterial and fish communities in rural piedmont streams of South Carolina.

Compared to similar areas in the southeast, the South Carolina piedmont is depauperate in its fish fauna, even in rural, forested locations. One hypothesis is that historical cotton farming may have degraded stream habitat quality, as several metals, notably arsenic and copper, were historically components of commonly used cotton farming pesticides. During the summer of 2009 we began investigating whether such metals were still present in rural and agricultural streams within the SC piedmont. We obtained sediment and water

samples and made biological measurements on abundance, diversity and community structure from rural sites in the piedmont to correlate environmental metal concentrations with biotic integrity. We hypothesized that arsenic and copper levels would be greatest close to historical mill sites and that as the distance from mill sites increased, so would biological diversity. Fish were collected using an electrofisher and seine, while total coliform, *Escherichia coli*, and *Enterococcus* bacteria levels were determined using IDEXX methodology. Arsenic and copper concentrations were measured using an ICP spectrophotometer. Results were equivocal. As distance from the mill sites increased so did biological diversity. However, while arsenic and copper were detected in sediment and in some stormflow water samples, levels did not correlate with biotic measures. One explanation is that relatively few sites were sampled, so increased sampling may lead to more significant relationships being detected. Additionally, a better understanding of the precise location of the historic cotton farms would allow us to select and organize study sites in a more controlled fashion.

O12.1 NORMAN DOUGLAS¹, WADE WALL¹, QIU-YUN (JENNY) XIANG¹, WILLIAM HOFFMANN¹, THOMAS WENTWORTH¹, JANET GRAY², AND MATTHEW HOHMANN³. Department of Plant Biology, North Carolina State University, Raleigh, NC 27695¹, Endangered Species Branch, Fort Bragg, North Carolina², US Army Corps of Engineers, Construction Engineering Research Laboratory³. Origin and relationship of the rare plant, *Lilium pyrophilum*, to other southeastern pendent lilies.

The pendent-flowered lilies of the Southeast include two common (Lilium michauxii and L. superbum) and two rare species (L. iridollae and L. pyrophilum). The latter two are narrowly distributed habitat specialists and are of conservation concern. When L. pyrophilum was described in 2002, three hypotheses were outlined concerning its origin: that it was a peripheral isolate of L. superbum, that it was a hybrid species, or that it was a disjunct isolate related to L. iridollae. To address the relationship of L. pyrophilum to its relatives, we undertook a genetic study employing data from four chloroplast loci, the internal transcribed spacer (ITS) and two nuclear intron regions. Multiple populations of all four species were sampled, encompassing the geographic range of the widespread species and of L. pyrophilum in North Carolina. Our results do not support a close relationship between L. pyrophilum and either L. iridollae or L. michauxii. However, a very close relationship was indicated between L. pyrophilum and L. superbum, with most genetic variation being shared between the two species. Analysis of our data in an isolation-with-migration framework indicated that L. pyrophilum was isolated at an early date (mid-Pleistocene or earlier), although gene flow between it and L. superbum has been ongoing and asymmetric (more frequent from L. pyrophilum to L. superbum). Thus it appears that the narrow endemic, L. pyrophilum, represents a significant repository of genetic information that has contributed to the genetic constitution of the widespread, ecological generalist, L. superbum.

O12.2 EMILY GILLESPIE AND KATHLEEN KRON. Wake Forest University. <u>Challenges and strategies in phylogeny reconstruction: A case study in the Ericaceae</u>.

The subfamily Ericoideae is a morphologically diverse clade of approximately 1790 species in 19 genera nested within the Ericaceae. Phylogeny reconstruction efforts within this clade provide opportunities to explore several analytical issues within a single clade, including issues of taxon and outgroup selection, model selection, choice of phylogenetic strategy, missing data and/or taxa, reconciliation of molecular phylogenetic relationships with morphological evidence and impacts on downstream analysis, such as historical biogeographical reconstruction. A six-gene analysis was carried out on a representative set of Ericoideae, using four distinct phylogenetic strategies (Maximum Parsimony, Bayesian analysis, and two distinct Maximum Likelihood strategies). The Ericoideae

exhibit multiple very short branches, particularly at the basal nodes within the clade, which tends to diminish resolution and support at those nodes. There are also multiple taxa that exhibit long branch attraction, a phenomenon known to complicate placement of those taxa within a broader phylogeny. The four tree-building strategies yielded radically different support for some nodes. Strategies for maximizing phylogenetic signal despite these problems among others are explored. Analysis of historical biogeography within the group is also undertaken, using newly emerging strategies that account for both phylogenetic and geographical uncertainty. It is more likely than not that any plant group will exhibit multiple analytical challenges in some combination. Solutions and/or mitigation strategies are increasingly available to maximize the value of data gathered and should be utilized as a matter of habit in phylogenetic studies.

O12.3 WENDY B. ZOMLEFER AND DAVID E. GIANNASI. University of Georgia. National Parks: The importance of vouchered floristic surveys.

Maintaining the integrity of our national parks is a continuing management challenge for the National Park Service: a balance of public use and protection of natural (and cultural) resources. By necessity, critical monitoring decisions involving exotic or rare plants have been previously based upon species lists derived from unvouchered reports and "sightings." The Park Service now recognizes the value of park floras supported by specimens deposited in recognized herbaria. The Southeast Coast Network, Division of Science and Natural Resource Management, has contracted University of Georgia Herbarium personnel to inventory and document the vascular plants at eight parks: four in Georgia, three in Florida, and one in South Carolina. This presentation is an overview of our progress on these National Park surveys over the past six years. Our published annotated lists plus cited vouchers comprise a reliable baseline inventory for each park. Encroachment of extensive development surrounding several of these parks threatens the native component of their flora, while likely contributing to an increase in invasives and weedy species that will require documentation. Continued inventory efforts should also concentrate on locating rare species previously reported but not verified by voucher specimens.

O12.4 PATRICK LYNCH AND WENDY B. ZOMLEFER. University of Georgia. <u>Floristic inventory and vegetation analysis of the South Atlantic Coastal Plain limestone forest.</u>

The South Atlantic Coastal Plain limestone forest is a globally imperiled (G2) forest association known only from the upper Coastal Plain of central Georgia and occurs along slopes and bottomlands of small stream tributaries of the Ocmulgee River in Houston, Bleckley, Twiggs and Pulaski Counties. These recently identified mesic hardwood forests are underlain by a complex calcareous substrate and support a diverse and unique set of floristic assemblages not previously subject to comprehensive floristic study. Ongoing field work will provide comprehensive floristic inventories and data for vegetational analyses incorporating physiographic determinants to quantify the environmental variables driving floristic composition and structure at the habitat and forest association levels. Research will conclude with Floristic Quality Assessments and provide measures of vegetational complexity and integrity and aid in the establishment of conservation priorities. Currently, large-scale logging operations and proposed residential developments threaten the survival of these communities; however, recent debate concerning state purchase of much of this land has considerable public backing. This study will support the state's acquisition of these lands, document and characterize remnant sites, and ensure long-term conservation of this rare endemic forest association.

O12.5 ELAINE DURCHHOLZ, MALLORY WILLIAMS, AND E. ANN POWELL. University of Evansville, Evansville, IN, 47722. Evolutionary relationships of the North American blueberries (Vaccinium, Ericaceae).

The North American species of *Vaccinium* include ecologically and economically important blueberry and cranberry species from sections *Cyanococcus* and *Oxycoccus*. These North American taxa have been poorly represented (or absent) in molecular phylogenetic analyses of the blueberry tribe (Vaccinieae) but may be critical for understanding the origin and evolution of blueberries. This study examines the evolutionary relationships of North American blueberry species using two chloroplast (*matK* and *ndhF*) and two nuclear DNA regions (ITS and *waxy*) and is the first study to examine the phylogenetic utility of *waxy* in the blueberry tribe. Results indicate that sections *Cyanococcus* and *Oxycoccus* are both monophyletic but are not sister taxa. The nuclear DNA region *waxy* is variable in the blueberries and provides phylogenetically informative characters useful in assessing blueberry relationships.

O12.6 BRUCE K. KIRCHOFF,. ROXANNE LEGGETT, VA HER, CHUE MOUA, JESSICA MORRISON, CHAMIKA POOLE. Department of Biology, University of North Carolina at Greensboro, Greensboro, NC 27402. New principles of visual keys illustrated through a visual key to the Fagaceae of the southeast.

Traditional keys are character based tools for plant identification. They are based on the decomposition of the plant into very small, atomistic parts, that are described with the technical and often arcane terminology of plant taxonomy. Even the best electronic keys (Lucid, Delta) make use of this terminology. Traditional keys are not based on pattern recognition, the forte of visual experts. Instead they demand that the user look at the plant as if it consisted of a series of isolated parts that are classified by name. Visual keys are solely, or primarily, image-based identification guides that make little or no use of terminology. Simple hunt-and-pick guides based on simple characteristics like flower color are not included in this definition. True visual keys make use of same types of information as traditional keys, but do so without terminology. At each decision point the user is presented with two or more sets of photographs of some plant character. Visual characters are defined following Kirchoff et al. (Taxon 56: 479, 2007). Selection of photos for inclusion in a set is based on the variability of the taxa in that set. Proper photo selection is the most crucial step in key construction. Selecting a photo set leads the user to the next level of photo sets until he or she is asked to choose a final identification. Key have been created for leaves, buds, bark, and fruit of the Fagaceae of the southeast. Complete novices have used the keys to make correct identifications.

O12.7 DWAYNE ESTES¹ AND JAMES BECK². Austin Peay State University's Center for Field Biology¹, Duke University². A new species of *Polymnia* (Asteraceae: Polymnieae) from the Sequatchie Valley of Tennessee.

Polymnia (Asteraceae) is an eastern North American genus of three robust herbs: *P. canadensis*, *P. laevigata*, and *P. cossatotensis*. Polymnia canadensis is widespread in eastern North America in calcareous forests. The rare *P. laevigata* has a disjunct distribution and occurs in mesic forests of the southern Cumberland Plateau region of Tennessee, Alabama, and Georgia, the panhandle of Florida, and the loess bluffs of the Mississippi River of Kentucky and Tennessee. Polymnia cossatotensis is known from four sites in the Ouachita Mountains of Arkansas where it is endemic to talus slopes. In September 2008, a new species of Polymnia was discovered in the Sequatchie Valley of southeastern Tennessee. It is known from just two populations in Marion County where it is restricted to limestone karst formations on forested mountainside slopes above the Tennessee River. This species resembles *P. canadensis* in its pubescent stems and leaves, relatively large capitula with numerous showy ray florets, and 3-ribbed cypselae

but differs in its uniquely dissected leaves and involucre pubescence. It resembles *P. laevigata* in having leaves that are more dissected than those of *P. canadensis*, but differs in its larger capitula with more numerous ray florets, fewer-ribbed cypselae, and distinctly pubescent stems and leaves. Cytological analysis revealed that this new species is a diploid like other *Polymnia*. Hypotheses concerning the origin of this new species are discussed.

O12.8 COURTNEY GORMAN, MATT BRUTON, AND DWAYNE ESTES. Austin Peay State University's Center for Field Biology. <u>Macrothelypteris torresiana</u> (Thelypteridaceae) new to Kentucky, with an update of its continued expansion in the United States.

Macrothelypteris torresiana (False Maiden Fern) is an Asian species first collected from Seminole County, Florida in 1904. Since then it has been documented from much of the lower southeastern United States and is now found throughout most of the region between South Carolina, Florida, and eastern Texas. Recently, False Maiden Fern has been documented expanding its range northward into the interior of the United States with reports from southern Tennessee, southwestern Virginia, and southern Illinois. Here, we report the first occurrence of *M. torresiana* from Kentucky. A discussion of the ecological conditions and associated flora of this population in comparison to others from the interior United States is also presented.

O12.9 CATHERINE BUSH¹, PETER W. FRITSCH², BONI C. CRUZ², ANGELA B. MARTINS³, LU LU⁴ AND KATHLEEN A. KRON¹. Wake Forest University¹, California Academy of Sciences², University of Campinas, Brazil³, Kunming Institute of Botany, China⁴. The phylogeny and morphology of the Brazilian Gaultheria (Ericaceae) species.

Six species of Gaultheria are endemic to the Mata Atlantica (Atlantic rainforest) in Brazil, several of which exhibit unique morphological characters. Gaultheria bradeana, G. myrtilloides, G. serrata and G. ulei all have the typical Gaultheria fruit morphology (capsular fruit surrounded by a fleshy calyx). However, G. itatiaiae and G. sleumeriana have capsular fruits and dry calyces which are otherwise present only in some species of Gaultheria in New Zealand as well as one species in temperate South America. Gaultheria bradeana has the unique characters of fleshy pedicels and bracteoles. Gaylussacia corvensis, recently understood to belong to Gaultheria, exhibits capsular fruits with only slightly fleshy calyx lobes. The endemic Brazilian species of Gaultheria have never been examined in a phylogenetic analysis. Analyses of a total combined dataset based on sequence data (matK, ndhF, trnL-F, trnS-G, rpl16, nrlTS, waxy and leafy DNA sequence data) including all Gaultheria species in Brazil except G. ulei yielded a clade of five Brazilian endemics. Gaultheria serrata var. serrata, a common endemic species, is sister to a clade of tropical South American Gaultheria species. Gaultheria erecta and G. eriophylla that occur disjunctly between southeastern Brazil and the Andes form a clade that is sister to G. schultesii from Mexico. The G. ser. Myrtilloideae clade is imbedded within a clade containing species from temperate South America, contradicting the hypothesis that the Andes have served as the only source area for the species in the Mata Atlantica of Brazil.

O13.1 SARAH GALLIHER AND DAVID VANDERMAST. Elon University. Effects of beech mortality due to beech bark disease on spring ephemerals in Great Smoky Mountains National Park.

Beech bark disease (BBD) has affected high elevation beech forests of Great Smoky Mountains National Park (GRSM) for over fifteen years. In the understory, spring ephemerals typically thrive in the high sunlight and moisture-rich conditions that

characterize the forest during the late winter and early spring months. The purpose of our study was to determine whether BBD affects the phenology of spring ephemerals. Our hypotheses were that in the diseased forest, 1) spring ephemerals would emerge sooner, 2) there would be greater spring ephemeral species richness, and 3) spring ephemerals would have greater average cover per quadrat. Beginning mid-March 2009, data were recorded approximately once a week over an eleven week period. We used sixteen 1m x 1m quadrats per forest type (healthy and diseased). In each quadrat, every plant species was recorded and given a cover category. Our results showed that 1) spring ephemerals did not emerge earlier in either forest type, 2) spring ephemeral species richness was consistently higher in the healthy forest, and 3) spring ephemeral cover was usually greater in the healthy forest. Contrary to the hypotheses, the diseased forest had significantly more total cover on most dates as well as greater species richness on the last four dates, but this was due to the presence of summer herbs species not found in the healthy forest type. Our results suggest that the spring ephemeral period is shortened in the diseased forest compared to the healthy forest because of accelerated emergence of summer herbs.

O13.2 EVAN ESKEW¹, ALICIA KRAWCZAK² AND STEVEN WHITFIELD³ Davidson College¹, Vanderbilt University², Florida International University³ Responses of terrestrial herpetofauna to secondary forest regeneration at La Selva Biological Station, Costa Rica

Amphibians and reptiles have experienced widespread, rapid declines in recent years. Although these declines are likely caused by a number of interrelated stressors, most recent research has focused on enigmatic factors such as disease and climate change while habitat change has received less attention. Conservationists still lack critical information concerning herpetofauna community responses to secondary forest regeneration. In this study, we used visual encounter surveys to sample transects for amphibians and reptiles in five forest types comprising four different age categories of secondary forest in addition to old-growth stands. Our results showed that the youngest secondary forest age category (1-15 years old) had greatly reduced species richness (six species) compared to other forest types which hosted between 11 and 13 species, and older forests tended to host more rare species than younger forest. Oophaga pumilio and Craugastor bransfordii were the most dominant species in all forest types and frogs were overall more abundant than lizards. These findings suggest that secondary forests may approximate old-growth forest levels of species richness in a relatively short time period (about 20 years), provided that these habitats are in close proximity to old forest stands which probably serve to supplement populations in regenerating habitats. Additionally, conservation of old-growth forest is likely necessary to ensure the persistence of some species that require mature habitats.

O13.3 DAVID VANDERMAST. Elon University. <u>Twenty-four years (1985-2009) of demographic changes in the high-elevation beech forests of Great Smoky Mountains National Park.</u>

Tree maps created in 1985 were used in 2000 and again in 2008-09 to examine size-specific mortality, ingrowth, and accretion of basal area (BA), and aboveground biomass (AGB) for trees in 11 late-successional, high-elevation beech forests in Great Smoky Mountains National Park. Mature beech forests are often assumed to grow slowly but in this study, basal area in forests unaffected by beech bark disease (BBD), which was discovered in the park in 1993, increased by as much as 41%, and AGB increased by 20%. In all cases, increases in BA and AGB were due primarily to accretion, rather than ingrowth. The cumulative accretion of BA and AGB was highest in the smallest stem size classes, but this was due to their greater numbers: the largest trees had the greatest percapita increases in these measurements. Furthermore, analyses on surviving beech trees

in forests with high BBD mortality indicate that they, too, had significant increases in BA and AGB. Because these surviving trees were heavily diseased, the increases must have occurred before the onset of BBD. The increases in BA and AGB observed in this study contradict the early descriptions of these beech forests as slow-growing climax forests surviving in extreme conditions. The beech forests in this study are growing at an anomalously high rate which suggests the influence of a novel environmental driver. Possible reasons for this anomalous growth rate will be discussed.

O13.4 NEIL PEDERSON^{1a}, KACIE TACKETT¹, RYAN MCEWAN², ADRIENNE COOPER¹, STACY CLARK³, UYANGA ARIYA⁴, CAROLINE LELAND¹, NATHAN MALCOMB¹, GLADE BROSI⁵, RAY EATON¹, R. DREW STOCKWELL¹. Eastern Kentucky University¹, University of Dayton², USDA-Forest Service - Southern Research Station³, National University of Mongolia⁴, University of Kentucky⁵. Prospects for reconstructing drought using non-classical dendroclimatological data.

Classical field methods of dendroclimatology in humid, temperate regions typically target trees growing on the most drought-prone sites. This method tends to limit investigators to a handful of species and, perhaps most importantly, excludes large amounts of tree-ring data that might improve drought reconstructions by increasing spatial density and species diversity. New data collected using classical and non-classical field methodologies allows for investigation into whether non-classical tree-ring data from humid, closed-canopy forests might be useful for dendroclimatic research. The data presented here consists of 10 new chronologies consisting of six species from six locations. Results indicate that within species/subgenera, two T. canadensis and Quercus subgenus Leucobalanus chronologies are significantly correlated annually and show coherence at multi-annual time-scales despite being nearly 90 km apart and collected via different methodologies. Records of ring index between classical versus non-classical collections and those from previously-cut versus uncut forests are significantly correlated over the 1731-1982 common period. Because of these strong relations, we combined the new chronologies using principal component analysis (PCA) to determine how they compare to a regional reconstruction of drought. The angiosperm PC's are significantly correlated to the regional drought reconstruction for the 1752-2005 common period, while the Tsuga-dominated PC is not. There are important caveats in the use of such data and need to be considered when using such data. However, if the patterns in growth found here persist with increased chronology and spatial replication, it suggests more data might be available to reconstruct climate history at regional to subregional scales.

O13.5 BENJAMIN O. KNAPP^{1, 2}, HUIFENG HU¹, JOAN L. WALKER², AND G. GEOFF WANG¹. Clemson University¹, USDA Forest Service². Restoration of native grass species following harvesting treatments at Fort Benning, GA and Camp Lejeune, NC.

Restoration of the longleaf pine ecosystem is one of the major challenges facing landowners in the southeastern US. In many cases, the native grasses that provide fine fuels for a high frequency fire regime have been eliminated from the system and require re-establishment. We evaluated the success of broadcast seeding vs. planting plugs of native grasses on two ecologically distinct areas within the southeast: the sandhills/loam hills of Fort Benning, GA and the coastal plain of Camp Lejeune, NC. Native species were planted at each location, including *Schizachyrium scoparium* and *Sorghastrum* spp. at Fort Benning and *Aristida stricta* at Camp Lejeune. We tested the effects of soil scarification prior to broadcasting seed and evaluated effects of burning on seeding success. We found that broadcasting seed was not successful at Fort Benning, but resulted in around one wiregrass germinant/m² at Camp Lejeune. Scarification prior to seeding increased seedling density (p = 0.0166) by nearly a factor of two. Further, we

tested the effects of canopy density (four levels: Control $\sim 15~\text{m}^2$ /ha basal area, MedBA $\sim 9~\text{m}^2$ /ha, LowBA $\sim 5~\text{m}^2$ /ha, and Clearcut = 0 m²/ha) on grass plug survival and growth at both sites and the additional effects of competition control and fertilizer on survival and growth at Fort Benning. *Schizachyrium scoparium* responded to canopy removal (p = 0.0002) and fertilizer application (p = 0.0108) with increased growth (number of tillers). Canopy treatments had no effect on *Aristida stricta* survival or growth after one growing season at Camp Lejeune.

O13.6 KATIE L. BURKE. University of Virginia. <u>American chestnut (Castanea dentata)</u> persistence and niche change in Southwestern Virginia eighty years after chestnut blight (*Cryphonectria parasitica*)introduction.

Disturbances such as logging are known to change spatiotemporal patterns within forests, but long-term effects on tree mortality due to the interaction of logging and disease are rarely studied. The American chestnut is a classic example of a foundation species' decline and niche shift following the introduction of the invasive pathogen chestnut blight, causing a dominant canopy tree to become a sterile understory tree that re-sprouts from pre-blight root stocks following infection. In a previous study, I have found that pre-blight chestnut density alone is not strongly correlated with post-blight chestnut density because chestnut decline is not equal across sites. Sites with high solar insolation (i.e., steep, south to west facing slopes) have lower chestnut loss. I asked the following questions: (1) What environmental factors are related to chestnut presence? (2) Does logging history affect chestnut abundance or presence on a site? Using pre-blight data of chestnut presence and density from a 1918 timber cruise and 1930s studies from Mountain Lake Biological Station, sites where chestnut was once present were re-visited in Giles and Craig Counties, VA. I expect sites with high chestnut abundance to have low blight prevalence, high solar insolation, low soil moisture, and low canopy density. I expect sites that have been logged for chestnut or that have a lower stand age to have fewer chestnuts. This study is important to the conservation of American chestnuts and more broadly compares population decline between sites experiencing one disturbance (disease) and two interacting disturbances (logging and disease).

O13.7 ALEX FOTIS AND JOYDEEP BHATTACHARJEE. University of Louisiana at Monroe. Modeling delayed succession in a bottomland hardwood forest after twenty-one years of natural succession.

Extensive research has focused on the ecology of old field succession, but few studies have concentrated on the natural succession of bottomlands. We examined a twenty-one year-old bottomland hardwood forest undergoing natural succession with another area planted with hardwood seedlings. The natural site experienced what is termed 'arrested succession' and consisted of an open field with scattered trees as compared to the closed canopy of the planted site. The herbaceous biomass and canopy cover varied greatly between sites. There was a strong negative correlation with herbaceous biomass and canopy cover. Based on these results, we developed a model that demonstrates that tree biomass is inversely related to herbaceous biomass and estimates when a closed canopy will form. This model predicts that at high levels of herbaceous biomass, such as during early succession, seedling growth and establishment will be delayed. Eventually, seedlings will become established, break through this layer and increase the canopy cover, killing herbaceous plants and facilitating seedling germination in close proximity. This will create a positive feedback of tree recruitment, and once a threshold of tree biomass is reached, the forest will switch to a closed canopy forest in a relatively short period of time.

O13.8 JACQUELINE M. WHITE AND ROBERT K. PEET. University of North Carolina at Chapel Hill. Spatial and temporal dynamics of tree seedlings in floodplain forests of the lower Roanoke River, North Carolina

Considerable resources have been allocated to conservation and restoration of floodplain forests associated with brownwater rivers because of their numerous ecological functions and services, but limited spatial extent. Imperative to the success of these management efforts is an understanding of forest dynamics and the implications of human activities for these processes. For example, changes to the pattern of flooding from river regulation may drive shifts in vegetation composition over time because tree species distributions on the floodplain are limited by flood tolerance. The regeneration layer should be the first indicator of such a shift, but in order to distinguish between natural and anthropogenic change, knowledge of the range of variation in tree seedling recruitment and survival across the flooding gradient is critical. To quantify spatial and temporal variation in seedling recruitment and survival we established seedling monitoring sites to span the range of variation in the flood regime on the lower Roanoke River and monitored these across three seasons. Overall, there was high spatial variation in seedling richness and abundance across the floodplain as both the abundance and species richness of seedlings declined with increased flooding. The highest variation in both space and time was observed in areas of intermediate flooding. Similarity between overstory and understory composition was typically high, but was lowest in areas of intermediate flooding. These results suggest that flooding reduces overall richness and abundance of tree seedlings, but composition change is most likely in the area of intermediate flooding where temporal variation in flooding is highest.

O13.9 MONICA POTEAT AND DAVID VANDERMAST. Elon University. <u>Inhibition of germination and growth as an explanation for the scarcity of red spruce (Picea rubens)</u> and Fraser fir (Abies fraseri) in the beech gaps of Great Smoky Mountains National Park.

In high elevation (> 1400 m) mountain gaps in Great Smoky Mountains National Park, relatively small (≤ 2 ha) monodominant stands of American beech (Fagus grandifolia) trees called "beech gaps" exist within a larger spruce-fir (Picea rubens-Abies fraseri) forest matrix. Within these beech gaps, the more widespread and abundant spruce and fir trees are rarely found. A greenhouse experiment was conducted to determine whether beech leaf leachate could inhibit germination or suppress early growth of these species. Twelve treatments with different water (dH₂O and leachate), soil (beech forest soil and top soil), and seed (lettuce (Lactuca sativa), red spruce, Fraser fir) combinations were tested. The beech forest soil-leachate treatment significantly reduced lettuce germination and the beech forest soil-dH₂O treatment reduced aboveground biomass (ABM). The top soilleachate treatment significantly reduced red spruce germination and ABM relative to other treatments. For Fraser fir, the beech forest soil-leachate treatment significantly reduced germination and ABM relative to the other treatments. Our results suggest that beech leaf leachate alone, or in combination with some chemical or physical aspect of beech forest soils, can significantly impair the ability of red spruce and Fraser fir to colonize highelevation beech gaps.

O14.1 NEIL GIFFEN¹ AND SCOTT REASOR². Oak Ridge National Laboratory: Environmental Sciences Division¹, Oak Ridge National Research Park². Reptile and Amphibian Abundance and Distribution Survey Oak Ridge National Environmental Research Park.

As a follow-up to a 1996 abundance and diversity study, we conducted reptile and amphibian abundance and diversity surveys during May through July in 2007, 2008, and 2009. The surveys were conducted in the Oak Ridge National Environmental Research

Park, located on the U.S. Department of Energy's Oak Ridge Reservation (ORR), in Tennessee. The area encompasses 33,654 acres. Our survey incorporated 20 separate sites on the ORR. The habitats covered during this study ranged from upland forested areas to low bottom wetland and stream areas. Several of the sites included native warmseason grass and old field locations. During the survey all captured reptiles and amphibians were released at the point of capture after identification and recording of measurements. The measurements were taken for future growth data analysis and included the specimen's weight, total length, and snout-to-vent length; for turtles we recorded just the length of carapace (top of the shell), the length of the plastron (bottom of the shell), and the depth of the shell. During the survey we used seven methods of capture: visual encounter surveys, artificial cover objects (wood and metal), pitfall traps with drift fence lines, minnow traps, dip nets, hoop nets, and acoustic surveys. In total, 360 specimens of 35 species were recorded during the survey. Species richness and diversity were compared to capture methods during the survey. Two species of interest that we encountered were the northern cricket frog (Acris crepitans) and the four-toed salamander (Hemidactylium scutatum).

O14.2 HARRY A. MEYER, BRAD PEET, AND JULIANA HINTON. McNeese State University. First report of terrestrial tardigrades from the Atlantic island of Bermuda.

Tardigrades (Phylum Tardigrada), also known as water bears, are minute animals, closely related to arthropods, found in leaf litter, soil, lichens, mosses, liverworts, and freshwater and marine sediments. We found six species of terrestrial tardigrade in moss and lichen samples collected on the North Atlantic island of Bermuda. These species included *Echiniscus cavagnaroi*, *Milnesium tardigradum*, *Macrobiotus harmsworthi*, *Macrobiotus hufelandi*, *Minibiotus* cf. *intermedius*, and an unidentifiable hypsibiid water bear. All species except *E. cavagnaroi* are cosmopolitan in distribution. Bermuda *Echiniscus cavagnaroi* differ from specimens collected from the Galápagos Islands, Georgia, Florida, and Louisiana in two respects: cirrus A is slightly shorter, and in about half the specimens lateral spine E is strongly serrated.

O14.3 DANIEL A. DOUGLAS, DAVID BROWN, AND NEIL PEDERSON. Eastern Kentucky University. <u>Land snails as indicators of old growth forests.</u>

Land snails are crucial to the functioning of ecosystems and serve as important food sources for many other species. These relatively sedentary creatures require certain conditions to thrive, which might make them particularly susceptible to disturbance. Therefore, old growth forest areas should be of higher quality habitat for land snails versus second-growth or cut-over forests. If so, land snails might be reliable indicators of old growth forest conditions. This study compared land snail species diversity and community composition in old growth and second growth forests in the Cumberland Plateau and Inner Bluegrass regions of Kentucky. Study areas were selected based on disturbance histories. Here I present preliminary data from Floracliff State Nature Preserve. For this study, special attention was given to micro snails (<5mm in diameter) as well as macro snails (>5mm in diameter). In the Inner Bluegrass Region, snail diversity is uniformly high, but community composition differs across the disturbance gradient in Floracliff. As this work continues, other old growth forests and second growth sites in the Cumberland Plateau and Pine Mountain will be studied, including Lilley Cornett Woods and Blanton Forest State Nature Preserve, two true old-growth forests. Data from these additional sites may reveal differences in land snail community patterns between old growth and disturbed forests, and potentially identify specific species that are indicators of forest disturbance history.

O14.4 SCOTT P. JONES AND THOMAS K. PAULEY. Department of Biology, Marshall University, Huntington, WV 25755, USA¹. <u>Urban Herpetology in and around Huntington</u>, West Virginia.

Urban herpetology is a relatively new field, examining how reptiles and amphibians survive in areas that have been altered by humans. This study sought to add data on urban habitats to the knowledge within West Virginia. We studied six sites: two urban parks, a nature area near an art museum, two wildlife management areas, and a state park. The state park and two wildlife management areas are considered non-urban habitats. The objective of this study was to determine how valuable urban habitats are as wildlife conservation areas. This goal was achieved by determining what reptile and amphibian species occupy these areas and by gathering data on various environmental variables at each site to better characterize the sites. Animals were observed with straight line transects and opportunistic searches at each study site. Each animal observed was weighed, measured for various lengths and widths, and its location data was recorded. To date, 6 snake, 3 turtle, 2 lizard, 8 salamander, 7 frog, and 2 toad species have been recorded. Species richness at each site ranged from 6 at one of the urban parks, to 13 at one of the wildlife management areas. Community similarity values ranged from 0 between one of the wildlife management areas and one of the urban sites, to 0.6 between a different wildlife management area and a different urban site. These data can be used to give a general idea of what species are likely to be found in other urban sites in West Virginia.

O14.5 JOHN TAGGART. University of North Carolina at Wilmington. <u>Floristics and</u> stewardship of Sandy Run Savannas State Natural Area, North Carolina.

Sandy Run Savannas State Natural Area is located in Onslow and Pender counties, North Carolina and encompasses 1,214 hectares of savanna, swamp forest, flatwoods, pocosin, and human-influenced communities. This recently acquired site consists of six tracts managed by the North Carolina Division of Parks and Recreation with another state-owned property to be added in the near future. A total of 588 taxa were collected during 2007-09 that included 23 species with federal and/or state status plus 29 other species considered rare by the North Carolina Natural Heritage Program. Two species, Cooley's meadowrue (*Thalictrum cooleyi*) and golden sedge (*Carex lutea*), have federal endangered species status; Carolina grass-of-Parnassus (*Parnassia caroliniana*), pineland plantain (*Plantago sparsiflora*), and Thorne's beaksedge (*Rhynchospora thornei*) are state endangered. Proposed stewardship for savanna, flatwoods, and pocosin communities will involve prescribed burning, while extant and harvested plantation areas will require restoration.

O14.6 R. STALTER¹, B. DREXLER² AND A. BRUNSON³. St. John's University. Vascular Plant Species Richness In Four Northeastern Cities.

We present and compare vascular plant species in Boston, New York, Philadelphia and Washington, DC. A total of 3,657 species have been reported in these four urban areas. Common to all four cities are 1372 species, 37.5% of the total. Factors playing a role in vascular plant diversity may be time of settlement, climatic variables (length of the growing season, minimum January temperature and maximum summer temperatures), amount of disturbance (mode, severity, duration) and land suitable for invasion and establishment of both native and non-native taxa.

O14.7 TERRY BOYER AND ROBERT CARTER¹. Department of Biology, Jacksonville State University¹. Community analysis of green pitcher plant (Sarracenia oreophila) bogs in Alabama.

The green pitcher plant (*Sarracenia oreophila*) is a carnivorous herb that historically populated portions of the Coastal Plain, northern Georgia and Alabama, the Cumberland Plateau of eastern Tennessee, and western North Carolina. Due to changes in land use, it has since become almost completely isolated to the Cumberland Plateau of Alabama, particularly Lookout and Sand Mountains. Multivariate analysis of bog vegetation from Sand and Lookout Mountains revealed three communities with unique species compositions. A *Quercus rubra*, *Arundinaria appalachiana*, *Pinus echinata* community was found on upland seepage bogs located exclusively on Lookout Mountain, close to the rim of the Little River Canyon and scattered along perennial streams. A *Quercus falcata*, *Diospyros virginiana*, *Rhododendron canescens* community was found on both Lookout and Sand Mountain and was typically found in flatter broad swales bisected by ephemeral streams. A *Viburnum nudum*, *Carex glaucescens*, *Rhexia virginica* community was found exclusively on Sand Mountain and in somewhat open areas that occasionally flooded. The results of this study can be used to find potential sites for restoration of green pitcher plant communities.

O14.8 ROBERT CARTER AND ROBERT FLOYD. Department of Biology, Jacksonville State University. Plant community analysis of the Pine Mountain Region of west-central Georgia.

Multivariate analysis of plant communities in the Pine Mountain Region of Georgia revealed ten unique communities. The communities were composed of a mixture of species with Appalachian, Piedmont, and Coastal Plain affinities. Species included *Kalmia latifolia*, *Quercus laevis*, *Q. prinus*, *Q. georgiana*, and *Pinus palustris*. A unique grassland community supported an overstory of *Prunus americana*, *Q. margaretta*, and *P. palustris*. The region currently is protected by state owned lands as well as a Boy Scout Camp. Expansion of protection and restoration of historic fire regimes is recommend for the region.

O14.9 WILLIAM A. MCAVOY¹, WESLEY M. KNAPP², AND LANCE T. BIECHELE. Delaware Natural Heritage and Endangered Species Program¹, Maryland Natural Heritage Program². The Liverworts and Hornworts of the Delmarva Peninsula's Atlantic Coastal Plain.

Of all the land plants the Bryophytes are one of the most understudied groups. In an effort to expand our knowledge of the diversity, distribution, and abundance of the Liverworts and Hornworts (Hepaticae and Antherocerotae) of the Atlantic Coastal Plain portion of the Delmarva Peninsula, field, literature, and herbarium studies were conducted over the past 6 years. A total of 65 taxa have been documented during this study with 22 taxa being reported here for the first time. The families with the largest number of taxa are the Cephaloziaceae, Lejeuneaceae, Ricciaceae, Frullaniaceae, Lophocoleaceae, and Calypogeiaceae. The largest genera are Cephalozia, Frullania, Riccia, Calypogeia, and Chiloscyphus. The majority of the hepatics are leafy liverworts with 45 taxa, followed by thalloid liverworts with 18 taxa. Hornworts are represented by two taxa. There are 21 taxa considered to be rare, or 32% of the flora. Of the 21 rare species, 5 are currently historical (not documented for 20 or more years). The County supporting the highest number of taxa is Worcester, with 47. The County supporting the lowest number of taxa is Cecil, with 13. Eight taxa occurring on the Delmarva are more southern in their geographic distribution and are at or near the northern limits of their range on the Peninsula. Only one species has a more northern distribution and is at or near the southern limits of its range (Chiloscyphus minor).

O14.10 KIMBERLY NORTON AND DWAYNE ESTES. Austin Peay State University. <u>A preliminary evaluation of the flora and vegetation of seasonally wet limestone cedar glades of the southeastern United States.</u>

Seasonally wet areas in limestone cedar glades of central Tennessee, central Kentucky and Northern Alabama were characterized using soil, hydrology and vegetation. In addition communities were evaluated according to U.S. Army Corps of Engineers wetland delineation procedures. 100 species were documented in 47 families and 86 genera. Sites are characterized by soil less than 10 cm. Soil is saturated from winter through spring. Sites appear to meet the requirements to be classified as wetlands, but additional soil sampling, hydrology monitoring, spring floristic data and vegetation analysis to determine percent cover of all species are yet to be completed.

O15.1 JESSICA M. CAMPO AND ROBERT B. ATKINSON. Center for Wetland Conservation at Christopher Newport University. Review and analysis of floristic quality using data mined from the monitoring reports of twelve wetland mitigation bank sites in Virginia.

A federal wetland permitting program has been in place for more than 3 decades and recent national studies have found concerns about the trade of natural wetlands for mitigated wetlands. Floristic quality index (FQI) is a measure of the quality of a plant community based on species richness and coefficient of conservatism values (C-values) and may provide insights into the status and succession of wetland mitigation sites. Quantitative plant data are typically required for monitoring of mitigation sites and may be used to quantify FQI of a site. Existing wetland compensation reports for 12 mitigation bank sites were used to calculate FQI in each year for which data were available. Mitigation sites ranged in age from 5 to 9 years post mitigation and were 0.58 ha to 37 ha in size. The data required to correctly calculate FQI was provided in 58% of reports obtained for this study. Based on these reports, FQI values across all monitoring years ranged from 12 to 30, and average FQI was 22 (FQI of 35 is the threshold to be considered a good quality natural area). Species richness varied across years and Cvalues remained relatively constant. A template for wetland monitoring reports is recommended in order to clarify data collection requirements and ensure that adequate data is included for the calculation of FQI and other parameters.

O15.2 CLIFF R. HUPP¹, AARON R. PIERCE², AND GREGORY B. NOE¹. U.S. Geological Survey¹, Nicholls State University². Floodplain geomorphic processes, equilibrium, and environmental impacts of human alterations along Coastal Plain rivers, USA.

Floodplains achieve their greatest North American extent on the Coastal Plain of southeastern United States. They are typically the most obvious fluvial landform. Human alterations along stream channels and within catchments have affected fluvial geomorphic processes worldwide. These alterations may reduce the important ecosystem services (such as, sediment and associated material trapping) that functioning floodplains provide. Similarly, these alterations may negatively impact the natural ecology of floodplains through reductions in suitable habitats, biodiversity, and nutrient cycling. Dams, stream channelization, and levee /canal construction are common human alterations along Coastal Plain fluvial systems. We use three case studies to illustrate these alterations and their impacts on floodplain geomorphic and ecological processes. They include: 1) dams along the lower Roanoke River, NC, 2) stream channelization in West Tennessee, and 3) multiple impacts including canal and artificial levee construction in the central Atchafalaya Basin, LA. Human alterations typically shift affected streams away from natural geomorphic regimes in dynamic equilibrium (sediment deposition/erosion). Regime changes initiate a period of complex responses that drive fluvial systems back toward equilibrium conditions. Identification and understanding of critical fluvial parameters involved in the responses (e.g. stream gradient, hydraulic connectivity) and process (spatial and temporal) trajectories should facilitate management efforts to retain and/or

regain important ecosystem services. The purposes of the present paper include the description of fluvial geomorphic dynamics as part of equilibrated alluvial systems and, alternatively, fluvial geomorphic dynamics and environmental impacts in the face of human alterations to equilibrated systems.

O15.3 HERMAN W. HUDSON III AND ROBERT B. ATKINSON. Christopher Newport University. The effect of adjacent forests on colonizing tree density in restored wetland mitigation sites in Virginia.

Although forested wetlands provide numerous ecological services, they are the most frequently impacted wetland type in Virginia. Compensation for impacts to this valuable resource is required under Section 404 of the Clean Water Act. In Virginia, the wetland mitigation woody vegetation success criterion is typically met when the stem count reaches 495-990 stems/ha (200-400 stems/acre). The purpose of this study was to determine and model patterns of pioneer woody species colonization in wetland mitigation sites within the Coastal Plain region of Virginia. Five Virginia Aquatic Resource Trust Fund (VARTF) wetland mitigation sites located in southeastern and central Virginia and restored by The Nature Conservancy were monitored for success in 2007 and 2008. Sites ranged from 4 to 7 years post restoration and from 3.2-ha to 24.7-ha. Trees greater than 1-m tall were identified to species and tallied in 160 10-m radius plots. In adjacent forests, basal area and height of trees within 10-m of the forest edge were measured in order to quantify the effect of seed source location and density. The most prevalent colonizing species were Liquidambar styraciflua>Acer rubrum>Pinus taeda and each species was a significant component of adjacent forest tree stratum. Colonization alone satisfied the woody vegetation success criterion in 126 of the 160 (79%) sampled plots. Density of colonizing trees was modeled using a forward stepwise regression which selected 5 of the 10 variables measured (r²=0.682, p<0.001). Understanding and predicting pioneer tree colonization will improve forested wetland compensation efforts by guiding planting strategies and improving tree establishment.

O15.4 MATTHEW SEMCHESKI, HAROLD G. MARSHALL, AND KNEELAND NESIUS. Old Dominion University. Seasonal patterns of microphytobenthic potential primary production in the lower chesapeake bay and its associated tributaries.

Primary production by microphytobenthos (MPP) is trophically important to a variety of micro- and macroheterotrophs in marine and estuarine habitats. In the Chesapeake Bay, these primary producers facilitate the survival and development of a number of ecologically and economically relevant vertebrate and invertebrate fauna. Measurements of primary production rates have been measured in habitats from sandy bottoms to tidal mudflats worldwide. However, productivity measurements in Chesapeake Bay are lacking, with only several published studies in the last 30 years. The aim of this project was to quantify microphytobenthic primary production rates in the lower Chesapeake Bay in relation to water column (phytoplankton) primary production (PPP). Additionally, seasonal variations in MPP and PPP were examined along with fluctuations corresponding to sediment composition and nutrient loads. Eight sites throughout the lower Chesapeake Bay were identified for measurements of MPP rates. Sites were sampled seasonally, with sampling at each site consisting of the following: 1) water column samples for PPP measurements, 2) sediment cores for MPP measurements, 3) sediment scrapes for community analysis and identification, 4) water column samples for laboratory incubations, 5) temperature and light (PAR) measurements. Samples were processed following a modified ¹⁴C-incubation protocol. MPP and PPP varied seasonally with temperature, salinity, and PAR changes. MPP and PPP also varied between stations. Phytoplankton and microphytobenthic community composition fluctuated both seasonally and between stations.

O15.5 DIANE DE STEVEN. U.S. Forest Service Southern Research Station. <u>Wetland</u> restoration practices in South Carolina's Wetlands Reserve Program.

The degradation of wetlands causes loss of significant ecosystem services such as floodwater storage, water-quality improvement, and habitat support. The U.S. Wetlands Reserve Program (WRP) provides financial incentives to restore degraded wetlands on private agricultural lands; however, virtually nothing is known about the nature and outcomes of these restorations in the Southeastern Coastal Plain. Knowledge of wetland hydrogeomorphic type and landscape setting are particularly important in estimating the potential recovery of ecosystem services. As part of a Southeast-wide study, nearly 80 WRP projects in South Carolina were reviewed to identify wetland types, restoration practices, and adaptation of practices to wetland type and setting. Restoration projects reflected wetland distributions across geographic subregions, and included diverse riverine, depressional, and wet-flat types. About half of the projects involved wetlands ditched and drained for agricultural uses, whereas the other half were bottomlands degraded by various timber extraction activities. Most projects involved practices designed to enhance habitat for waterfowl, but restoration methods varied with wetland type and past impacts. Depressional, wet-flat, and low-order river sites were typically restored by methods to disrupt artificial drainage and/or increase water retention. In contrast, restoring mainstem river floodplains focused on removing barriers to water flows and recovering biologic connectivity. Virtually all projects relied on natural revegetation. Restoration of degraded river floodplains is a distinctive feature of South Carolina's WRP efforts. Future work will assess whether restoration practices have achieved "on-the-ground" improvements in wetland condition.

O15.6 JAMIE A. DUBERSTEIN¹, KEN W. KRAUSS², AND WILLIAM H. CONNER¹. Clemson University¹, U.S. Geological Survey, National Wetlands Research Center². Physiological and growth differences of mature baldcypress trees in relation to salinity in "freshwater" tidal swamps undergoing persistent drought.

Tidal freshwater swamps, occuping the upper reaches of tidal influence, begin active conversion to oligonaline marsh at salinity levels as low as 2 g/l. The most imminent climate-induced threat to existing tree communities in tidal swamps is increased salinization resulting from sea level rise, a condition exacerbated by drought. Baldcypress is the primary tree species surviving in the ecotone between tidal swamp and oligohaline marsh. Survival of mature trees exposed to salinity can persist for decades, although it is unknown why baldcypress can survive while other tree species cannot. We hypothesized that alterations in patterns of water use by mature baldcypress trees enable survival on moderate salinity sites. Mature trees in a low salinity tidal swamp (0.6 g/l average, 1.0 g/l peak drought) and a higher salinity tidal swamp (1.3 g/l average, 5.5 g/l peak drought) were monitored to examine differences in growth and water use patterns. Dendrometer bands were used to measure growth while heat dissipation probes were used to measure sap flow rates at various sapwood depths. Trees from the saline site had reduced growth and overall sap flow, with peak rates of sap flow nearest the cambium. Trees on the freshwater site had increased rates of sap flow at deeper sapwood depths, contributing to higher rates of water use on the freshwater site. We surmise that salinization of tidal swamps forces shifts in tree osmotic balance and water use strategies to extend survival time on sub-optimal sites, which further influences growth and morphology.

O15.7 PUJA SHRESTHA, NEIL BILLINGTON, AND M. WAYNE MORRIS. Troy University. Genetic variation in bald cypress and pond cypress populations from southeastern Alabama.

Bald cypress (*Taxodium distichum*) and pond cypress (*Taxodium ascendens*) are closely related species, but show morphological and ecological differences. They are long lived,

deciduous, wetland species that are commonly found in swamp forests of the southeastern United States. This study examined genetic variation among bald cypress and pond cypress populations, and between the two taxa. Leaf samples were collected from ten populations of bald cypress from southeastern Alabama and two pond cypress populations, one from Houston County, Alabama and one from Franklin County, Florida; 12-24 trees were obtained from each population. Proteins were extracted from leaf samples with plant grinding buffer and separated by electrophoresis on cellulose acetate gels with two buffer systems, tris glycine and tris citrate. Nine enzyme systems were screened revealing 14 loci, of which 10 were polymorphic in bald cypress and 11 in pond cypress. The percent polymorphic loci in bald cypress and pond cypress were 71.4% and 78.6%, respectively. Mean heterozygosity for bald cypress and pond cypress was 0.183 and 0.200, respectively. Eight additional protein systems were screened to search for fixed differences between bald cypress and pond cypress, but none were found. From a dendrogram of the genetic relationship between bald cypress and pond cypress it was observed that the two pond cypress populations were segregated from the bald cypress populations. This information on genetic structure of bald cypress and pond cypress populations could lead to valuable insights into their genetic conservation and management.

O15.8 WILLIAM DEGRAVELLES¹ AND WILLIAM H. CONNER^{1,2}. Clemson University¹. Clemson University Baruch Institute of Coastal Ecology and Forest Science². The effects of artificial canopy gap creation on baldcypress (*Taxodium distichum* L.) sapling growth in a North Carolina swamp: Initial response.

Given anthropogenic alterations to forested floodplains across the southern U.S., an increased understanding of the community ecology and species-specific responses to various forms of disturbance is continuously warranted to foster improved management of these ecologically and economically important ecosystems. We characterize the forest structure and composition of the 'backswamp' of the Broadneck Swamp floodplain of the lower Roanoke River, eastern North Carolina, and report initial (1st growing season) diameter growth response of variously-sized, suppressed understory baldcypress (*Taxodium distichum* L.) saplings to artificial canopy gap creation in 19x24 m plots. Results show gap creation (via girdling and herbicide injection of all non-baldcypress trees and shrubs) significantly increases growth across all diameter classes, though early suppression effects may be present in larger (presumably older) saplings. The findings of this multi-year study are potentially useful in managing forested wetlands for specific objectives related to baldcypress.

O15.9 HENRY SPRATT¹, INIGO HOWLETT¹, AND GREG BRODIE². University of Tennessee at Chattanooga¹, Tennessee Valley Authority². Microbial processes occurring in a constructed wetland treating acidic seep waters at the Tennessee Valley Authority, Widows Creek Fossil Plant, Stevenson, Alabama.

TVA has treated acidic seepage from coal ash piles at the Widows Creek Fossil Plant using a constructed wetlands-based passive system since the mid 1990's. This system uses a series of three Vertical Limestone Drains (VLDs), along with anoxic and aerobic marshes, and open water ponds. This study sought to relate sediment microbial activity throughout the VLDs to effective leachate treatment. Rates of bacterial sulfate reduction (BSR) and heterotrophic bacterial (HB) activity, and quantities of several mineral components of sediments collected throughout the VLD cells seasonally during 2007 were determined. Rates of BSR and HB varied over different sampling dates, but followed a pattern across the cells. The three VLD cells always had the greatest microbial activity, where HB ranged from 0.3 to 0.9 mgGlucose/g/da, and BSR rates ranged from 15 to 53 mmol/g/da. Seepage water had an average pH of 3.7, which was raised to 7.0 at the final

discharge. Sediment C and N were greater in VLD cells (C range, 20 to 24 mmol/g, N range 1.3 to 1.8 mmol/g), while S generally tended to be higher in VLD cells (S range 0.22 to 0.55 mmol/g). Preliminary data suggest that metal-sulfide minerals often linked to BSR are actively sequestered in the VLDs. Results of this study suggest that conditions favorable to microorganisms in the VLD cells encourage continual accumulation of C, N, and S, and possibly metals in those sediments. This suggests that TVA's approach using the VLDs should continue to provide effective remediation for this problem water.

O15.10 TODD EGERTON, MATTHEW SEMCHESKI, HAROLD MARSHALL, RICHARD HUBBARD, ANDREW GORDON, PATRICK HATCHER. Old Dominion University. Algal biomass to biodiesel: year two; seasonal characterization of phytoplankton composition in an open raceway and related studies.

A 1-acre raceway was constructed and inoculated in Prince George County, VA September 2008 as part of the Virginia Coastal Energy Research Consortium's algal biodiesel research focus. Monitoring results indicate the green algae (Chlorophyceae) have remained the most prolific group, consisting predominantly of species belonging to the *Desmodesmus/Scenedesmus* complex. Using scanning electron microscopy and nuclear ribosomal sequence analysis, the dominant taxa for the first year was identified as *Desmodesmus asymmetricus*. In the fall of 2009, *D. asymmetricus* densities declined as the colonial chlorophyte *Oocystis borgei* became established in the raceway. Stochastic events such as pollen deposition and the introduction of predatory zooplankton have corresponded with changing algal densities and composition. Investigations into zooplankton control mechanisms, intra-specific variation, and lipid content of other taxa are also currently being conducted.

O16.1 MEGAN RAMSEY. Piedmont College. <u>The Effect of Aquatic pH on the Survivability of a Macroinvertebrate Shredder</u>, *Hyalella azteca*.

An experiment assessing the survivability of *Hyalella azteca* exposed to different pH solutions was performed. Most studies do not utilize pH as a variable, rather maintain it at a constant level. Unlike previous research, this study singled out the variation in pH to determine if it caused a significant change. A phosphate buffer system was used to lower and raise the solution pH. Survivability was tested at a pH of 5, 6, 7.8, 8 and 9. *H. azteca* were maintained in a series of sand filled fountains. Ten specimen per fountain, with three fountains per treatment were observed for one week. Constant temperature was maintained, and specimen were fed a premeasured amount of food once a day. After one week the specimen were removed and the number of deceased was logged. Statistical analysis of the final data shows that pH's of 5, 6, and 9 significantly impact survival when compared to the control pH of 7.8.

O16.2 MATTHEW P. TRUMP AND RONALD V. DIMOCK, JR. Wake Forest University. Feeding morphology of juvenile *Utterbackia imbecillis*.

While some research in regard to feeding has been performed on juvenile freshwater mussels, relatively little is known about the feeding morphology and pathways of particle uptake in unionid mussels from the time at which they drop off their fish host to the point that they are bona fide filter feeders with typical adult anatomy. Further definition of the juvenile stage of freshwater mussels may provide clarity in the literature of young unionid biology. This project aims to describe the ontogeny of feeding structures in juvenile *Utterbackia imbecillis*. *U. imbecillis* were cultured in the laboratory using standard in vitro techniques. Individuals were sampled weekly and observed using scanning electron microscopy to document the development of feeding morphology. By providing more knowledge concerning the feeding structures and behavior of juvenile unionid mussels,

more effective feeding regimes and conservation strategies may be implemented in the battle to conserve what is one of the most endangered groups of organisms in the world.

O16.3 SUSAN SEWELL¹, MARK MEADE², AND FRANK ROMANO². Gadsden State Community College¹, Jacksonville State University². Metabolic rates of an aquatic tardigrade, *Dactylobiotus* of *ambiguus*.

Tardigrades include one of the most elusive groups of microscopic animals on earth. Over the last few decades, researchers have made great strides deciphering the phylogenetic groups of tardigrades, however, limited information is known about the basic biology of these animals. Tardigrades have been observed to form cysts and enter a suspended state of animation during stressful environmental conditions. As with other animals, it has been hypothesized that metabolic rates must change dramatically in these animals as environmental conditions change. Methods of accurately measuring metabolic rates (i.e., oxygen consumption rates) in microscopic animals have been limited by the ability to monitor low rates of consumption as well as miniscule changes in oxygen tensions. Previous studies on microscopic animals have used "Cartesian Diver" techniques and modern polarographic oxygen sensors; however, the ability to accurately monitor rates is still debated. We report here the use of a fiber optic probe microrespirometry system used to monitor oxygen consumption rates in aquatic tardigrades. The system is highly sensitive (accuracy ±0.15% at 1% air saturation with a limit of detection of 15 ppb dissolved oxygen) and is not prone to drift as polarographic sensors are. In preliminary studies, oxygen consumption rates were determined for individual tardigrades. We report here the benefits of this system and the effects of various temperatures on metabolic rates.

O16.4 JOHN McCREADIE AND CHRIS BEDWELL. University of South Alabama. <u>Is</u> competition evident in small, low gradient southern coastal streams?

The evidence for strong interspecific competition among stream insects has been mixed, with the general consensus that stream conditions are too disturbed for competition to be a major mechanism of community structure. In low gradient, sandy bottom streams of coastal Alabama, the most productive habitat for stream insects is very limited and patchy, consisting many of isolated log jams and leaf packs. Such habitats are ideal systems for testing the role of competitive exclusion in stream ecosystems as they provide discrete, small, bounded habitats. Two distinct guilds of stream insects were examined – riffle beetles (Elmidae: Coleoptera) which decaying wood shredders and dragonflies (Anisoptera: Odonata) which are predators. Data was collected from 17 streams (5 samples /stream) during both summer and fall conditions. Evidence for competitive exclusion was determined using null model of co-occurrence with each guild and season analyzed separately. The test statistic was the mean C-score and simulation variants were run with the constraint that the simulated occurrence of each species among sites was equal to observed occurrence. No strong evidence of competitive exclusion was found although evidence for interspecific competition was found among some species pairs.

O16.5 MAGHAN WOODS AND MATTHEW WATERS. Shorter College. Rome, GA. Evidence of multiple trophic state changes in the paleolimnological history of Lake Apopka, FL.

Lake Apopka, in the northern region of Florida, has been heavily researched because of its increasing importance in the fishing industry. In 1947, Lake Apopka abruptly changed from an oligotrophic system to a highly eutrophic state and has remained in this state until present day. While there is much debate over the causative factors for the abrupt change, few studies have looked into the recent paleolimnological history of Lake Apopka. For our research, cores were taken from Lake Apopka, FL and sampled. Nutrient data (nitrogen,

phosphorous, and sulfur) and percent organic carbon were used as a proxy to determine nutrient inputs into the system. Photosynthetic pigment analysis was completed using high performance liquid chromatography (HPLC) and data were analyzed to approximate historic primary producer community assemblages. Our data demonstrates the 1947 change in trophic status and also indicates that Lake Apopka experienced smaller changes in trophic state in the past.

O16.7 THOMAS MCELROY AND WILLIAM ENSIGN. Kennesaw State University.

Historical and contemporary effects of dams on the distribution of genetic diversity for Campostoma oligolepis in the Etowah River

The largescale stone roller (*Campostoma oligolepis*), is an abundant fish species in the Etowah River ecosystem. The broad distribution of this species makes it a useful organism to assess the conservation implications of severing the connectivity of a water system that is home to many species. We have examined the variability at several highly variable genetic loci (STR, microsatellites) and mitochondrial D-loop haplotypes among 22 collection sites of *C. oligolepis*. This study makes use of nuclear and mtDNA to investigate how historical and contemporary evolutionary processes have influenced the spatial and temporal distribution of genetic diversity in *C. oligolepis*. The STR data suggests that the populations above and below Allatoona Dam are genetically distinct. Further, small dams significantly affected the distribution of genetic variation among sites within creek systems. The mitochondrial haplotype data suggests that the Etowah river *C. oligolepis* population is derived from a single historical population, thus the detected divergence among sample sites for microsatellite genotypes was likely the result of contemporary ecological factors.

O16.8 NATALIE A. AMOROSO AND DAVID R. CHALCRAFT. East Carolina University.

<u>Dragonfly colonization history alters insect biodiversity within ephemeral ponds</u>

Interactions among species can play an important role in controlling biodiversity. Some studies, however, demonstrate that the timing at which species arrive into a community could alter the nature and intensity of species interactions. Such priority effects should be important in disrupted environments where the process of community assembly is reset. Larval dragonflies are important predators in ephemeral ponds, but the timing at which dragonflies arrive into a recently filled pond depends on breeding phenology and the ability of dragonflies to find and oviposit in ponds. We conducted an experiment in artificial ponds designed to mimic natural ephemeral ponds to test the hypothesis that the biodiversity of aquatic insects present in ephemeral ponds depends on when larval dragonflies enter the process of community assembly. We found that more dragonflies metamorphosed from ponds when dragonflies colonized ponds early in the assembly process than in ponds where dragonflies colonized later. Early-arriving dragonflies appeared to inhibit the successful recruitment of late-arriving dragonflies. Continuous colonization by dragonflies into a pond reduced the species richness of insects in comparison to ponds where dragonflies could only colonize either early or late in the assembly process. Furthermore, ponds that were colonized by more dragonflies tended to have a lower abundance of insects that compete with dragonflies. The timing of dragonfly arrival, however, had no affect on the biodiversity of species susceptible to dragonfly predation. Our results indicate that the timing at which key species arrive in a community can substantially alter the biodiversity of an ephemeral pond.

O16.9 Canceled

O16.10 MEGAN WHITE, ERIK JOHNSON, AND RONALD DIMOCK, JR. Wake Forest University. Using freshwater mussels as biological indicators: <u>The physiological responses of Utterbackia imbecillis</u> (Bivalvia: Unionidae) to copper exposure.

Evaluating solely abiotic factors in aquatic ecosystem assessment is inadequate and provides only a single snapshot in time of what is going on in the water body. Biotic indicators, on the other hand, are able to convey the cumulative effects of stressors on aquatic life. Biological indicators, or sentinel species, provide valuable assessment information by offering a direct link between a stressor and its effects on an organism's physiology. Freshwater mussels are ideal indicator species for use in aquatic ecosystem biomonitoring due to their wide geographic distribution, abundance, sedentary lifestyle, and filter-feeding habit. This study identified sublethal copper dosages for acute exposure in Utterbackia imbecillis and assessed several physiological responses of U. imbecillis to copper, an ecologically relevant stressor that is toxic to many molluscs. The active period (percentage of time valves are open), oxygen consumption rate, and clearance rate (volume of water filtered per unit time) were examined under normal and copper stress conditions using standard techniques. A dosage of 100 ppb copper as CuCl₂ was determined to be sublethal to adult *U. imbecillis* for acute (96-hour) exposure. While oxygen consumption rates of copper-exposed mussels were not significantly different than those of controls, there was a significant decrease in active period and filtration rate with copper exposure. These changes exemplify the sensitivity of freshwater mussels to copper, even at sub-lethal levels, and validate the use of *U. imbecillis* as an indicator species.

O16.11 CAROLINE E. ROONEY¹, THOMAS H. MARTIN¹, STEVE J. FRALEY² AND WILLIAM T. RUSS². Western Carolina University¹, North Carolina Wildlife Resources Commission². <u>In-situ feasibility study of freshwater mussel reintroduction: survival and growth of the wavy-rayed lamp mussel (*Lampsilis fasciola*) in the Pigeon River, NC</u>

The Pigeon River, NC has a long history of habitat degradation due to high levels of toxic effluents from and water diversion to a paper mill. Over the last 20 years the paper mill has modernized its processes and reduced water use and waste production greatly. Historically the wavy rayed lamp mussel, *Lampsilis fasciola*, was present throughout the river, it currently only persists upstream of Canton, NC. In this study, we compare the survival and growth of *L. fasciola* placed in the downstream portion of the Pigeon River with those placed upstream of Canton, NC. The mussels are individually marked and caged in portable concrete silos designed by Chris Barnhart from Missouri State University. The mussels were placed in the river at 2 upstream sites and 3 downstream sites in December 2008. We will present monthly survival and growth data collected from December 2008 to November 2009.

O16.12 ERIN E. SINGER AND MICHAEL M. GANGLOFF. Appalachian State University. Mill dam effects on freshwater mussels in an Alabama stream.

Small dams are commonplace in the southeastern US, yet few studies have quantified their effects on the region's imperiled aquatic biota. I investigated why freshwater mussel populations directly below mill dams are frequently larger (both densities and body size) than populations in up- or downstream reaches. Specifically, I asked two questions: 1) are larger mussels growing faster or living longer? and 2) are size differences attributable to increased mussel food availability? I aged shell thin-sections to determine growth rates and then compared growth of populations near mill dams to up- and downstream populations. I then evaluated mussel food (seston) quantity and quality, by filtering water samples (250 ml) through 1.0 µm glass fiber filters. Preliminary shell data revealed significantly higher mussel growth rates in the mill reach compared to up- and downstream reaches and I am currently generating additional age-at-length data to build growth models for each population. Seston levels were greatest in the mill pond and immediately downstream of the pond. However, seston quality (i.e., organic:inorganic ratio) was greatest upstream of the mill pond. Water chemistry data revealed that summer nitrate

levels were greatest in the upstream reach and decreased downstream. This suggests that the mill pond and its associated phytoplankon may be a nutrient sink. Further, they suggest that some mill ponds may have heretofore un-appreciated positive effects on some freshwater mussel populations including increased shell growth rates. Beneficial effects appear to be linked to physicochemical changes that promote nutrient retention and phytoplankton production.

O16.13 JOHN HAINS, JESSIE ULMER, CHRISTINA DARLING, DAMON FLOWERS, CRAIG HOSSENLOPP, STEPHANIE WILLETT, IRIS REDWOODSAWYERR, KRISTINE GRIFFIN, AND CARL DIXON. Clemson University. The Invasion and Behavior of Bellamya japonica (von Martens 1861), a New Invasive Snail to the Savannah River Basin.

Although Bellamya japonica (aka Japanese Mystery Snail) is a well-known elsewhere in North America, the early detection of this invasive exotic species in the Savannah Basin has given us the opportunity to study its dispersal and other aspects of its ecological characteristics. Not only has this freshwater gastropod invaded Lake Hartwell near Clemson, SC, but it has also caused damage and costs to the infrastructure of the support facilities of the university. Because of this our study has focused on its distribution and behavior. We conducted field observations and laboratory experiments to test this organism's phototactic responses. Field observations indicated that for the same habitat, more snails were visible after the nocturnal period when compared to the diurnal period. This was a repeatable observation. Lab experiments further showed a significant negative response to light and subsequent refinement of the experiment to minimize a potential geotactic component still supported the hypothesis of light avoidance through phototactic response. Further refinements of this approach will incorporate other refinements such as potential wavelength-dependence and size (age) dependence. This research will contribute to our understanding of the ecological interactions of invasive aquatic species with the additional goal of developing practical methods of exclusion to minimize infrastructure costs in the future. Our team gratefully acknowledges support from the Clemson University Creative Inquiry Program for undergraduate research and also support from the Clemson Service Alliance Citizens and Scholars Program.

O16.14 PATIA M. CONNELL AND DAVID R. CHALCRAFT. East Carolina University. Native rather than introduced species of crayfish have stronger per capita effects on *Bufo fowleri* tadpoles.

Predators have been shown to alter important fitness components (larval period, mass at metamorphosis, and overall survivorship) of larval anurans. Uncommonly studied predators of tadpoles include crayfish. Both native and introduced crayfish occur in NC. To gain a better understanding of the effect of introduced crayfish in NC, we examined the impact of native (Procambarus acutus) and introduced (P. clarkii) crayfish on Fowler's toad larvae (Bufo fowleri). We hypothesized that P. clarkii would have a greater effect on fitness components of Bufo fowleri because it is larger, more aggressive and invasive in many parts of the world. Because these two species of crayfish can co-occur, we conducted an experiment to evaluate the independent and interactive effects of the two crayfish species at different densities (0, 1 or 2 individuals present). We found that crayfish did not alter toad larval period, but reduced toad survival and caused toads to metamorphose at larger masses. The effect of crayfish on toad survival and mass at metamorphosis increased with crayfish density. Interestingly, native crayfish caused a stronger reduction in survival and a stronger enhancement in mass at metamorphosis than did introduced crayfish when present at similar densities. Although toad survivorship in ponds with both crayfish species was comparable to survivorship in ponds containing only native crayfish, toads metamorphosed at larger sizes when both crayfish species were present. We caution, however, that P. clarkii can achieve higher densities than P.

acutus in some situations and may have a more important effect under high-density conditions.

O17.1 TRAVIS PERRY AND MEGAN PITMAN. Clemson University. <u>Developing a cost effective census tool for puma (*Puma concolor*) using remote camera detection probabilities.</u>

Puma (*Puma concolor*) are charismatic large carnivores that present a number of significant conservation challenges. Most puma conservation issues concern either confirmation of puma presence or reliable puma population estimates, both of which are extremely difficult to obtain given pumas' low population densities, secretive habits, and relatively uniform markings. Utilizing 24 months of data from 2 ear-tagged and 6 GPS collared puma and a standardized array of 16 remote cameras, we have developed a population estimate tool for puma management. Camera detection probabilities for collared puma are applied to remote camera data to extrapolate a resident puma population estimate. These results are then compared with a puma population estimate derived from a mark-resight population estimate.

O17.2 JENNIFER CARMAN AND JEREMY HYMAN. Western Carolina University. Investigating morphological variation in song sparrows (*Melospiza melodia*): a preliminary study.

Beak morphology in birds is a trait known to respond quickly to natural selection on feeding ecology. This investigation looks at potential differences between two populations which could point to ecological divergence. We collected data on 63 birds at two sites, Kituwah Mound near Bryson City, NC and Cullowhee, NC, and compared seven pairs of morphological measurements. Significant variation was found between the two populations in beak depth measurements (p=0.002) but not in overall body size. It is hypothesized that differences in the available food sources at the two sites is the driving factor of this change. Further investigations are needed to evaluate the extent to which the food sources differ and whether the separate populations are both diverging from one common starting point or if the urban birds are branching from the rural or vice versa.

O17.3 TIMOTHY WHITESIDE II AND CHRISTINE FLEET. Emory & Henry College. Understanding the fis Gene's Effect on the Gibberellic Acid Pathway in Arabidopsis Thaliana.

Using *Arabidopsis Thaliana*, a plant often used in genetics, molecular biology, and light sensitivity studies; we studied variations of the *fis* mutation (*fis1* & *fis3*) which are polycomb group genes responsible for affecting embryonic development. An organism with this type of mutation phenotypcially shows half of the viable offspring. The plant hormone Gibberellic Acid (GA) is responsible for the stimulation of seed germination and promotion of stem and root elongation. Its biosynthesis pathway contains several different genes which are responsible for encoding different enzymes. Continuing from our previous research, which involved finding where *FIS* affected GA production using a reporter gene known as GUS, we recently wanted to find how the *fis* variations affected the GA pathway on a molecular expression. Using techniques such as PCR and qRT-PCR, we wanted to find the role of the *fis* mutation on the GA pathway and production. In addition, we wanted to compare the interaction of GA biosynthesis genes with the *fis* alleles using previously researched bioinformatics data. This included comparisons of intensities and interactions between different GA genes such as *KO*, *KAO*, and *3ox3* and as well as certain areas in embryonic stages of the *Arabidopsis*.

O17.4 SARAH PATE AND ZACK MURRELL. Appalachian State University. Phylogeography of the threatened *Spiraea virginiana* Britton.

According to the fossil record, Appalachian plants were pushed south towards warmer climates near the Gulf of Mexico and Atlantic Ocean during the Last Glacial Maximum, outside of their current range of the Tennessee, Cumberland, and Ohio River drainages. However, mountain climates provided multiple refugia during the last glacial retreat. A diverse flora and a large number of endemic species within the Cumberland Mountains of Tennessee and Kentucky suggest that many of these plants remained in these heterogeneous environs during the process of glacial metamorphosis. A representative of this group of endemic species, *Spiraea virginiana* Britton, occupies a very specific niche and may be doubly limited by low genetic diversity due to the isolation of its populations. In order to examine patterns of early migration within the species, we studied the phylogeography of *S. virginiana* and hypothesized that southern populations of *S. virginiana* have more ancestral characteristics. Using non-coding chloroplast DNA sequences and nuclear inter-simple sequence repeats (ISSRs), we were able to examine divergence at multiple scales.

O17.5 ELIZABETH MIHALCIK¹, MALIK HAYNES², AND FRED THOMPSON³. Albany State University¹, Florida A&M University², Florida Museum of Natural History³. Distribution of the tree snail species in the Florida Keys with special consideration to *Orthalicus reses reses*.

In 2007 and 2008, the Florida Keys were surveyed which included Key Largo to Key West for Orthalicus reses reses, the endangered Stock Island Tree Snail. This snail was named where it was originally collected on Stock Island, a neighboring island to Key West. The purpose of this study was to document the range for the USFWS. We also surveyed any other arboreal gastropod species found within the area. Initially, we visited the mollusk research collection at the Florida Museum of Natural History to differentiate between Orthalicus reses reses and the other arboreal relatives Orthalicus reses nesodryas, Orthalicus floridensis, Liguus fasciatus, and Drymaeus multilineatus by examining voucher specimens. Field work was conducted in the hardwood hammocks using vegetation maps. At each location visual observations were made on the trunks of trees, branches and underneath leaves. Forty-eight locations were surveyed. The results showed only a few remaining hardwood hammocks left. They are isolated due to the vegetation changes in residential and business districts. The number of live snails were limited to only several individuals at each location. Live Orthalicus reses reses were found attached to Pigeon Plum and Poisonwood trees of Key Largo, Big Pine Key, and No Name Key. The conclusion of the surveys showed that the range of Orthalicus reses reses has been significantly reduced from the 1995 USFWS survey which may be due to drought conditions or to the habitat loss. We also believed that the some of the scientists had been misidentifying these snails in past surveys.

O17.6 JACQUELYN S. HOWELL¹ AND ASHLEY B. MORRIS². University of South Alabama. Species Distribution and Hybridization of Sarracenia at Splinter Hill Bog Preserve.

Carnivorous plants are fascinating due to their ability to utilize insects and other unfortunate prey for nutrition. The genus *Sarracenia* (Sarraceniaceae) is found primarily in the southeastern United States, with only one species (*Sarracenia purpurea*) radiating up the east coast, across the Northern United States and boreal Canada west to British Columbia. Modified leaves of pitcher plants act as pitfall traps to capture prey; enzymes within the pitchers then degrade the bodies of their prey for nutrients. Currently, eight to nine species are recognized depending on the taxonomic treatment, along with several subspecies and varieties. Difficulty discerning species has often been associated with morphological plasticity and apparently limited genetic differentiation, which have allowed for extensive hybridization among sympatric species. Hybrids are fertile and capable of

crossing back with the parent species. The relative distributions of sympatric species seem to be controlled by some underlying factor (e.g., soil type, hydrology, etc.). However not much has been done to explain possible causes for these distributions. Previous molecular studies of *Sarracenia* based on ITS and *rbcL* have been unable to resolve species-level relationships. Our research will implement microsatellite markers, which are rapidly evolving and codominant, making them ideal molecular tools for addressing the taxonomic issues at hand. Geological parameters (e.g. hydrology and soil types) will be measured and mapped in an attempt to better understand what causes species distribution and separation across this nutrient poor landscape.

O17.7 WADE WALL¹, NORMAN DOUGLAS¹, QIU-YUN (JENNY) XIANG¹, WILLIAM HOFFMANN¹, THOMAS WENTWORTH¹, JANET GRAY², AND MATTHEW HOHMANN³. Department of Plant Biology, North Carolina State University, Raleigh, NC¹, Endangered Species Branch, Fort Bragg, North Carolina², US Army Corps of Engineers, Construction Engineering Research Laboratory³. No evidence for southern refugium during the latter Pleistocene in *Pyxidanthera barbulata*.

The alternating glacial and interglacial periods during the Pleistocene had a major impact on the distribution of plant species in Eastern North America, with range shifts for a number of species into southern refugia. However, the Atlantic Coastal Plain physiographic region has been understudied, and most studies to date have focused either on widespread species that occur across multiple physiogeographic regions or more narrow endemic species that exhibit little latitudinal variation. Pyxidanthera barbulata is an Atlantic Coastal Plain endemic plant that occurs in a variety of habitats from New York and New Jersey south to South Carolina. Currently, there are two recognized morphological types that occupy different ecological habitats, and there has been ongoing debate as to whether the two types are separate species or two varieties of the same species. We investigated the phylogeography of Pyxidanthera barbulata using cpDNA and AFLP markers, and revisited the taxonomic question in light of both morphological and genetic data. Using a variety of summary statistical and coalescent approaches, we found no evidence for a southern refugium or range shift during the Pleistocene. Population genetic diversity estimates for northern and southern populations were similar, and there was no decrease in rare alleles in northern populations. Although the two varieties exhibit morphological differences, there is very little genetic differentiation between them. It thus appears that var. brevifolia represents an ecological variant morphologically differentiated from var. barbulata that only develops under extreme edaphic conditions in the Carolinas and we recommend varietal status for the two taxa.

O17.8 JAMES S. BARDSLEY¹, ROLAND P. ROBERTS¹, LARRY WIMMERS¹, ANDRE WELLS¹, SARA CAMPBELL¹, OLATEJUMADE ADEGBENRO¹, KARIMAT OKANLAWON¹, ASHLEE PHILYAW¹, DARIN A.SUKHA², DAVID R.BUTLER², FRANCES L.BEKELE², SARAH BHARATH² AND JAMES A.SAUNDERS¹ Towson University Department of Biological Sciences 8000 York Road, Towson, MD 21252-0001¹. University of West Indies Cocoa Research Unit, St Augustine, Trinidad and Tobago, West Indies². Detection of Misidentified Plants in the International Cocoa Genebank, Trinidad.

The tropical fruit tree, *Theobroma cacao*, is the source of cocoa that is used in the manufacturer of a wide variety of chocolate products. The seeds do not remain viable for much longer than a week after harvest and the species is highly polymorphic, therefore germplasm collections must be maintained as living trees that are clonally propagated. The largest public internationally accessible cacao collection in the world is the International Cocoa Genebank, in Trinidad (ICG,T) with over 2,300 accessions. This collection strives to represent each accession with 16 trees cultivated in a single plot.

Misidentifications can be introduced into such collections by the rooting of aerial portions of fallen trees in neighboring plots, the re-growth of rootstock from grafted material, and mislabeling as trees are replanted or replaced in a plot. Earlier studies using morphological characteristics identified mislabeling frequencies of up to 43% in *T. caca*o genebanks. To definitively assess the degree of mislabeling of the ICG,T collection, Towson University and the University of West Indies have evaluated the incidence of errors using 15 SSR sites to genotype 123 trees representing 16 accession lines. The number of individuals per accession ranged from 2 to 27 with most accessions represented by 9 or fewer trees. Mortality of plants in the field resulted in only one accession represented by the 16 plants desired per plot. The occurrence of mislabeling was as high as 56% in some accessions. The overall incidence of mislabeling in the ICG,T is approximately 25%.

O17.9 CHRISTIAN JOHNSON AND JENNIFER RHODE WARD. University of North Carolina at Asheville. <u>Morphological Change in Piriqueta cistoides caroliniana</u> (Morning Buttercup) Leaves under Different Moisture Extremes.

The Piriqueta cistoides caroliniana hybrid complex is a model system for the study of moisture stress adaptation in plants. This complex exists as multiple morphotypes characterized by their adaptations to differing moisture habitats. We analyzed leaf phenotypes of three morphotypes under field conditions, then tracked phenotypic changes in plants exposed to controlled moisture extremes. Height, node production, leaf growth, stomatal density and trichome density were measured to quantify each morphotype's response to moisture stress. No difference was found in leaf area and trichome density among morphotypes under field conditions, while height and stomatal density did differ significantly among morphotypes under these conditions. Leaf area, stomata and trichome densities differed among populations. Under controlled conditions, morphotypes responded differently to each moisture extreme, producing statistically different amounts of vegetative growth. No statistical differences were found in the number of nodes produced, height, leaf area, or stomatal density among morphotypes and treatments. However, the hybrid morphotype differed from the viridis and caroliniana morphotypes in trichome density. This macrophenotypic research, in combination with molecular analysis, could yield ways to improve crop cultivation and agricultural efficiency under extremes of moisture availability. Ongoing work is using leaves and tissue samples collected from this experiment to quantify gene expression via microarray analysis.

O17.10 Canceled

O17.11 ROSE GRINNAN. North Carolina State University. <u>The effects of climate change on plant – herbivore interactions in soybeans (Glycine max)</u>.

Global climate change is predicted to bring about increases in both temperature and drought, as well as an increase in herbivorous insect populations. Currently, we have very little understanding of how plants, especially our agricultural crops, will respond to such changes. To address this we used soybeans, an important crop, to examine how temperature change, drought and herbivory singularly and in combination affect soybean performance. We also examined how temperature change and drought affect herbivory on soybeans. We conducted greenhouse and growth chamber experiments using a soybean variety commonly grown in North Carolina and experimentally manipulated temperature, water supply (drought) and herbivore damage. We found that both drought and herbivory had a significant negative effect on plant above- and below- ground biomass production, while the interaction of the two was not statistically significant. An increase in temperature increased the rates of germination, growth, and the negative effects of drought and herbivore damage. From this research, we conclude that the predicted climate change will increase the potential for stress related damage to soybeans and that it would be

beneficial to explore new varieties of soybeans that can withstand increased levels of drought and herbivory in light of global temperature change.

O18.1 WELCH, NICOLE TURRILL. Mississippi University for Women. Where oh where has the carbon gone? Student misconceptions of carbon dynamics contribute to their inadequate understanding of global climate change.

A scientific understanding of global climate change requires one to scale biological processes underlying carbon sources and carbon sinks to ecosystem net primary productivity and, globally, the accumulation of greenhouse gases in the troposphere. As part of a national project, this research used diagnostic question clusters (DQCs) to assess student understanding of carbon dynamics and global climate change. Sixteen third and fourth year biology and biology education majors enrolled in a general ecology course voluntarily completed pre- and post-test sets of DQCs during the Fall 2009 semester. Pre-tests were given on the first day of class, prior to distribution of any course information, and post-tests were administered during the last week of the semester. All course lecture and lab activities employed active learning strategies, and two semesters of introductory biology and one semester of introductory chemistry were prerequisites for this course. Pre-test results revealed that students lack basic understanding of terrestrial carbon dynamics, incorrectly stating that the carbon reduced during photosynthesis is absorbed from the soil instead of from the atmosphere. Students did not connect the accumulation of glucose from photosynthesis as lignin and other plant macromolecules with plant growth or carbon sinks. Many also thought that reducing or stabilizing anthropogenic emissions of greenhouse gases will result in immediate temperature responses and climate stabilization. The course and its active learning strategies corrected these misconceptions for some students, but not all. If students retain these misconceptions, they will not be literate members of society on the topic of global warming.

O18.2 STEPHANIE JEFFRIES. Duke University. What can first-year college students teach us about rare plants? Designing academic writing classes that contribute to conservation through service learning.

First-year college writing classes often tackle topics in the humanities and social sciences, but topics in the natural sciences are either underutilized or limited to writing about science rather than teaching science writing. I wanted to teach the writing practices of my discipline while contributing to plant conservation research. I designed a first-year academic writing class where students conducted fundamental library research on rare plant species and proposed research questions to increase our understanding of these rare species and critical needs for their conservation. The pedagogy centers on the final projects, with key assignments and practices built along the way for scaffolding. Since the focus is on academic writing, rather than content, innovative methods are used to bring students up to speed on various issues related to the topic. The end result is that students learn how to develop insightful research questions while also learning fundamental writing practices that they can take with them to their classes in other disciplines. Partnerships with outside organizations raise the quality and importance of students' work as well as contribute to understaffed agencies with ambitious conservation goals.

O18.3 C. BRIAN ODOM. Wingate University. <u>A "No-Cost" bioinformatics laboratory exercise for non-major biology courses.</u>

Bioinformatics/Genomics is one of the many biological "buzz words" that has become ever so popular with the mass media. It is important in non-major courses to show relevance between content material, especially laboratory exercises and things that are occurring in the "real world" of the student's daily lives. This laboratory uses commonly available word

processing software to perform various simple bioinformatics-type "searches" within the genome of an indeterminate organism. This laboratory is also designed to be run in around the same amount of time it takes to run an agarose gel (60 minutes), thus eliminating laboratory "down time" while gels are running.

O18.4 PEARL R. FERNANDES. University of South Carolina Sumter. <u>Engaging Students in Proactive Citizenship</u>.

The presentation highlights methods to foster active learning in science courses by connecting scientific content to context and engaging students in civic issues. An allied health course with lab contents included modules on civic engagement through incorporation of the American Society of Microbiology's "Take Action Clean Hands Campaign." Classroom discussions and reports were designed along this theme. Students collected data in the campus and community on this topic, and presented their findings in both oral and written format. A pre and post test of student's attitudes towards science was conducted through the SENCER Student Assessment of Learning Gains (SENCER-SALG; http://www.salgsite.org/), an online survey to assess student attitudes toward science. Additionally, an assessment of students' knowledge and behaviors towards hand hygiene was developed. A Clean Hands Campaign Day was implemented on the campus, where all students were invited to learn the importance of hand washing and the proper hand washing technique. Students also conducted their campaign in the Sumter community. The results indicate that the campaign helped students see the significance of their course work, and how the classroom could be used as a platform to engage in proactive citizenship. For faculty, the campaign was an effective way of meeting the tri-fold goals of teaching, scholarship and service.

O18.5 BETH ANNE PAULEY. Marshall University and University of Charleston. <u>Science education and the case for online instruction</u>.

Online education is a growing trend in the United States with online enrollments growing faster than traditional enrollments. Online learning is cost effective when implemented correctly and can lead to positive student learning, although research is limited on this aspect. Science is a content area that has not fully embraced online delivery because science pedagogy is often rooted in a transfer of a body of knowledge utilizing hands-on inquiry methods. Many science educators argue that using constructivist techniques can not only enhance science learning but can be easily applied to online instruction. Characteristics of effective online instruction include constructive feedback, linking inquires to real world problems and providing challenges and support to students. These are also characteristics of constructivist learning. Convincing science educators that constructivism is a viable instructional strategy is a first step in establishing the feasibility of online science instruction. Certain aspects of traditional science education, such as labs can be accomplished through online experiences such as virtual labs and computer modeling. The use of learning objects such as these can provide positive learning experiences and an online alternative to traditional class settings. This presentation will incorporate research-based techniques on how to effectively take science courses online with suggestions on how to integrate problem-based learning and suggest novel approaches to inquiry based learning activities.

O18.6 DARLENE PANVINI. Belmont University, Nashville, TN. Smuggled! An Environmental CSI Lab Investigation.

Using an inquiry-based, case study approach, a crime scene investigation lab activity was created to introduce high school students to the environmental ramifications of illegal pet smuggling. Students complete a series of lab activities (blood typing, soil analysis, and hair and parasite identification) to determine which suspect illegally imported a monkey

from South America. Students gain exposure and practice with dissection and compound microscopes, pH meters, and other basic lab equipment. Critical thinking skills are required in order for students to sort through the data – not all of which leads to the solution to the crime. The lab was developed for high school juniors and seniors visiting Belmont University for a day of "lab explorations." This session will describe the lab activity, how Belmont students have been involved in the development of the lab and how they interact with the high school students during the lab. Evaluations of the project from both the high school and university students suggest that this activity enhances science learning for both groups, confidence with scientific equipment, leadership abilities, and interpersonal communication skills.

O18.7 ROGER SAUTERER. Jacksonville State University. <u>From backwater to center stage</u>: <u>Using electronegativity as a central concept for understanding chemical principles in introductory biology courses.</u>

The chemical property of electronegativity is at best mentioned briefly or not at all in introductory biology texts, yet can be an integrative concept for understanding properties of molecules, bonding, polarity and redox reactions in the chemical principles part of introductory biology courses. A brief discussion of what electronegativity is and a simple line graph representing relative electronegativities of atoms used in life processes serves as a central concept that allows better student understanding of core chemical principals, especially for students whose chemical background is weak. Studying the electronegativity line graph helps students to understand why certain elements for ionic bonds while others form covalent bonds, the critical concept of polar and hydrophobic molecules, the formation of hydrogen bonds, and finally, why oxygen is used as an electron acceptor in processes such as oxidative phosphorylation. Numerous positive student comments indicate that it is an effective tool for understaning basic chemical and biochemical principals.

O18.8 ROGER SAUTERER Jacksonville State University. <u>Integration of earth history and paleobiology into introductory biology courses as a tool for understanding biological diversity and evolutionary principles.</u>

Surveys of organismal diversity and their adaptations is an important part of introductory biology courses. A seldom-used but useful approach is to integrate aspects of paleobiology and earth history into the discussion of organismal features and diversity. This can help students understand why certain organisms became dominant in the global ecosystem while others declined and can reinforce major evolutionary principles. Among these include: Organisms adapted to one environment may suffer decline and even extinction while others diversify if the environment changes (example: Permian environments and the rise of reptiles and seed plants), the development of new biochemical or genetic mechanisms can lead to massive diversification of life (ex: Development of chitin exoskeletons and calcified extracellular matrix and the Cambrian explosion), biogenic processes can alter the global ecosystem and alter evolution of life (ex: oxygenic photosynthesis, rising oxygen levels, and the development of oxidative phosphorylation and ROS mitigation enzymes), new symbiotic relationships can lead to adaptations to environmental change (ex: symbiotic cellulose-digesting bacteria and the ability of mammals that exploit grasses as food) and that mass extinctions can lead to adaptive radiations (ex: the K-T mass extinction and the rise of dominant mammals). Discussion of key events in the history of life and the global environment not only reinforces evolutionary concepts but also gives students a better appreciation for the diversity of past and present life and life's ability to adapt to changing environments. It also reinforces concern about the possible effects of rapid global warming on current ecosystems.

O18.9 BRCUE K. KIRCHOFF, MARGARET HORTON. Department of Biology, University of North Carolina at Greensboro, Greensboro, NC 27402¹. <u>Teaching</u> plant identification through effective homework.

Woody Plants of the Southeastern United States: A Field Botany Course on CD is a learner-centered, active-learning, computer program designed to efficiently teach plant identification. It was produced in 2008 and is published by Missouri Botanical Garden Press. A updated version of the program was tested for efficacy in an upper-division plant systematics class at UNC Greensboro in spring 2009. The upgrade contains all of the features of the original, but also allows instructors to create customized scripts that define study sessions for students. The program tracks student progress through the scripts by way of output files that record students' grades on the quiz and test routines. These output files can be emailed to the instructor, or uploaded onto a course contend delivery system such as Blackboard as a way of assessing students' work. The new scripting functions allows the creation of effective homework assignments. Students' performance on the plants leaned with the help of the software was compared with their performance on plants that were learned without it. Use of the WPSEUS scripts resulted in an 18.5% improvement in taxa recognition. This improvement was highly significant (p = 0.000). Anonymous evaluations demonstrated that the students were highly appreciative of the software, and interested in seeing its use expanded.

O18.10 VAHE OHANYAN AND BRIAN C. McCARTHY. Ohio University. <u>Integrating</u> software applications for the study of ecoinoformatics.

Ecoinformatics, a sub-discipline of bioinformatics, is a rapidly emerging research area, especially amongst vegetation ecologists. Many scientists are familiar with the challenges of analyzing large ecological data sets or attempting meta-analysis of multiple data sets. Consequently, ecoinformatics is a good tool to accelerate the problem solving process and automate the data analysis step to be more reliable, efficient, and replicable. Recent advances in computer software applications will greatly facilitate such analyses. In particular, R and Kepler are well suited to these purposes, because of their continued support and open source nature. R is primarily used by biologists for statistical analysis, while Kepler is designed for dataflow automation. Both of these programs can be easily interfaced. Both have been used for certain types of diversity and community data handling projects in the recent past. Here we present a detailed example of how R and Kepler can be integrated to increase the efficiency and efficacy of a typical plant community diversity analysis. Based upon the code developed for this project, one needs only supply a standard data set in spreadsheet format as input. The application automatically generates summary data and various graphs and tables. Three models were developed for different types of plant community data. We envision a broad range of applications for research and teaching in the future development of these applications

O18.11 LINDSAY WALKER AND DARLENE PANVINI. Belmont University. An examination of closed system compost maturity using three different starting materials: mature compost, soil, and commercial compost starter.

Natural degradation of composting matter varies according to the conditions of the starting materials. Composters have several options for amending compost to enhance the rate of decomposition of kitchen or yard waste so that nutrients are cycled back into the system more quickly. The purpose of this study is to observe the natural degradation process as it is related to different amendments to raw composting materials. Twelve closed-system buckets were set up to hold three repetitions of four different variables of compost: "plain" containing only lettuce and leaves; "compost" containing lettuce, leaves, and mature compost; "soil" containing lettuce, leaves, and soil; and "starter" containing lettuce, leaves, and a commercial compost starter. Temperature, soil moisture, and pH of leachate were

recorded weekly. A seed germination maturity test using compost "tea" was performed at 4 weeks and 8 weeks. Results show significant variance in the pH of "starter" leachate as compared with other starting materials. There are qualitative differences among the different compost types including the presence of flies in all of the different types of compost other than "starter." Color and consistency also vary among the different types of compost. Temperature readings were very low throughout the experiment, most likely as a result of the small scale of the compost. The two-bucket system used in this project is a good model for teaching composting.

O18.12 WILLIAM DEES¹, TERRY SYLVESTER¹, BENJAMIN CLARK¹, LILNDA CANNING¹, AARON FIGUEROA¹, RICHARD HOPES¹, AND DANIEL KLINE². McNeese State University¹, USDA/ARS Center for Medical, Agricultural and Veterinary Entomology². "Simple-to-build" equipment for laboratory and field mosquito investigations.

Two low-cost laboratory and field devices – a mosquito rearing chamber and a trap designed for field testing attractants and repellents against mosquitoes – are described. The rearing chamber is made from plastics recycled from common household products, such as peanut butter jars and room deodorizers. The trap uses a standard Centers for Disease Control light trap modified for variable release of test chemicals. The cost for the rearing chamber is negligible. Trap modification costs are less than \$2.00/trap. A demonstration of these two devices will be presented.

O19.1 JOHN R. EVANS AND JOEY SHAW. University of Tennessee at Chattanooga. <u>A preliminary flora of the Sequatchie Valley in Sequatchie County, Tennessee.</u>

The vascular flora of the Sequatchie Valley within Sequatchie County, Tennessee is currently under study. The Sequatchie Valley is generally considered to be part of the Cumberland Plateau physiographic province, yet much less floristic attention has been given to the valley than the plateau proper. Although ten separate floras have previously been conducted on the Cumberland Plateau, very little collection at all has occurred within the Sequatchie Valley. The explanation for this disparity, and the justification for correcting it, may be one in the same: a number of geological and ecological factors distinguish the Seguatchie Valley from the rest of the Cumberland Plateau. Created by extensive erosion through layers of exposed limestone, the valley is 400 m lower than the surrounding plateau. The resulting microclimate is warmer and dryer than the elevated plateau, and the valley is physically isolated from other low-lying areas to the east and west of the Cumberland Plateau. Habitat and vegetation types within the 147 km² study area vary considerably across a patchwork of land uses. Habitats range from relatively undisturbed secondary forest to old-fields, pasture, cultivated cropland, and highly disturbed highway corridors. As of January, 2010, approximately 1300 specimens have been collected. Of these, 342 species in 96 families have been positively identified. Intensive collection and analysis will continue through the fall of 2010.

O19.2 GERALD WOODWORTH AND JOEY SHAW. University of Tennessee at Chattanooga. <u>Establishment of Permanent Plots and Analysis of Woody Vegetation in the Tennessee River Gorge, Marion and Hamilton Counties, TN.</u>

The Tennessee River Gorge is located five miles to the west of Chattanooga, TN in the Cumberland Mountains along 27 miles of the Tennessee River. Previous studies in the area have shown the region to be understudied and highly diverse. Studies using long-term monitoring plots have shown their usefulness in observing changes over time and discovering the underlying causes. I established 100 plots of $100m^2$ in the gorge. The plots were distributed within communities identified in 1984 for the Tennessee River Gorge Trust. All woody species over 5 cm dbh were recorded within the plot and field

identification was attempted for all species. The basal area, dominance, frequency and importance were calculated for the plots, communities, and all plots combined. The results were compared to the descriptions of the communities of the gorge. The results of many communities matched their descriptions. However, there were several communities with results that did not match up with their descriptions. This is primarily due to succession in communities that were in early successional stages or due to a low sample number. This study is beneficial by allowing a more detailed analysis and comparison of future change within the communities of the gorge.

O19.3 EMILY BLYVEIS AND JOEY SHAW. University of Tennessee at Chattanooga. <u>A preliminary flora of the Tennessee River Gorge, Hamilton and Marion counties,</u> Tennessee.

The Tennessee River Gorge (TRG) consists of twenty six miles of river canyon in the southeastern region of the Cumberland Plateau in Hamilton and Marion counties, Tennessee. Bridges et al. characterized 16 vegetation types and 20 unique habitat types within the riverine, upland, and gorge areas of the TRG in their 1984 survey. This diverse array of natural communities is known to support such rare species as Fothergilla major, Panax quinquefolius, Sabatia capitata, and Scutellaria montana. The subject of this inventory is strictly the southern gorge land area which includes ca. 4,003 hectares from the riparian edge to the escarpment apex. The goals of this study are to inventory the vascular flora of the TRG, document the presence of rare and introduced species, report county records for Hamilton and Marion counties, and compare the completed inventory to seven other regional floras to determine the relative species richness of the TRG. From March to October 2009, 20 collecting trips were made, and a total of 247 specimens were collected. One hundred fifty four species from 65 families have been documented thus far. The dominant families are Fabaceae with 17 taxa and Asteraceae with 12 taxa. Eighteen introduced species were documented, including Albizia julibrissin, Lonicera japonica, and Paulownia tomentosa.

O19.4 GEORGE CLINE, SAM SUTTLE, AND ROBERT CARTER. Jacksonville State University. <u>Analysis of southeastern herpetological communities: Lizards and turtles.</u>

The southeastern United States is a hotspot for herpetological diversity. In this study we examine the diversity of lizard and turtle communities in the Southeast. We collected distribution data from 47 sites reporting lizard species and 48 sites reporting turtle species from across the southeastern United States. The literature records indicate 15 species of lizards recorded across all sites. The number of species per site ranged from 1-11 species. Of the lizards observed, 3 species should be considered common (reported from at least 27 of the 47 sites) while the remaining species were less common (reported from 1-9 of the 47 sites). Turtles were more numerous with 30 species being reported across these sites. Species richness ranged from 1-14 species reported from these sites. Three species were widely distributed (reported from 27- 41 sites), while the remaining species were less common (reported from 1- 19 sites). Factors related to species richness as revealed through multivariate analysis will be discussed for both groups.

O19.5 DAVID BROWN AND TODD WEINKAK. Eastern Kentucky University, <u>Bird communities of hemlock forests in Kentucky</u>.

We conducted a preliminary assessment of bird-hemlock associations in Kentucky's Appalachian Mountain region. Based on a single year of point count surveys, we found six bird species with positive associations to hemlock forest and five species with negative associations (avoidance) with hemlock forest. This is the first step of a before-after-impact study of the effects of hemlock woolly adelgid on bird communities of Kentucky. Such bird

community changes have been documented in several comparative studies in other areas of the eastern United States, but unlike our work, other studies generally were initiated post-infestation and thus lacked pre-infestation data. We are also using adelgid treatment efforts, conducted in partnership with federal and state land management agencies, to experimentally test the effects of hemlock mortality on bird communities and populations, as well as the efficacy of adelgid treatments for bird communities. We predict that in untreated hemlock, bird communities will experience substantial change including local loss of bird species that positively associate with hemlock, and increase of species that avoid live hemlock. We expect bird communities in treated areas to be resistant to such change. Specifically, species such as Acadian flycatcher, Blue-headed vireo, and Black-throated green warbler should maintain similar levels of abundance. Our research also has implications for Swainson's Warbler, a state-listed species of conservation concern. We found a strong positive association of Swainson's warbler with hemlock, but additional work is needed to understand this relationship.

O19.6 BRETT MACEK, GEORGE CLINE, AND ROBERT CARTER. Jacksonville State University. Analysis of southeastern herpetological communities: Frogs and salamanders.

The southeastern United States is known as a hotspot for herpetological diversity. In this study, we examine the diversity of amphibian communities based on richness data from 41 sites. The data were taken from published manuscripts, or from unpublished projects with the approval of the researchers. Taxonomic changes that have been made since these papers were published have been corrected here when possible. The cumulative species list from literature records that we examined indicates a total of 93 species of both orders of amphibians, including 58 species of salamanders and 35 species of frogs. Species richness ranged from 5-48 species reported from these sites. Four sites (9.7%) had very high species richness (36, 37, 44, and 48). Seventeen sites (41.5%) had high species richness (20-30 species). The remaining sites (48.8%) were considered to have low species richness (5-18 species). Many of the species had very narrow distributions; 28 species were restricted to one site and 59 species (63% of total) were found at 9 or fewer of the sites. By contrast, only 15 species were widely distributed (reported from at least 21 of the 41 sites) and 34 species (37% of total) were found at more than 9 sites (11-38 sites). Factors related to species richness as revealed through multivariate analysis will be discussed for both groups.

O19.7 DOSHIE SMITH AND LISA KELLY. University of North Carolina at Pembroke.

Population Demographics of Woody Goldenrod (*Chrysoma pauciflosculosa*) in Lumber River State Park, North Carolina.

Understanding population demographics is critical for management of rare species. Woody goldenrod (*Chrysoma pauciflosculosa*), a habitat specialist of xeric soils, is a state endangered species in North Carolina. This shrub, found in three coastal plain counties of the state, can live for ≥17 years. The largest population, located on Big Sandy Ridge (Columbus County) in Lumber River State Park, exists as multiple subpopulations separated by forest patches and dirt roads. During fall 2009, we estimated population densities and sizes for three subpopulations by counting all plants (≥10 cm in crown diameter) in 1-m wide belt transects. To determine size classes for two subpopulations, we counted number of internodes and measured height and crown diameter for all plants (≥10 cm in crown diameter) in a single belt transect; seeds were collected for a propagation study. A community analysis was conducted using a 0.1-ha plot, in which all vascular plants were inventoried. Mean population densities ranged from 1.1-2.2 plants m² (11000-22000 plants ha⁻¹). Most plants belonged to small size classes (10-20 cm tall and 10-20 cm crowns), but large plants (≥40 cm tall and ≥50 cm crowns) were observed. We hope to relate size classes to age by comparing number of internodes, height, and crown

diameter to annual growth rings. Differences in subpopulation densities could be related to past site disturbances (e.g, logging and horse traffic).

O19.8 ROBERT D. TOMPKINS¹, WILLIAM C. STRINGER², KEITH RICHARDSON³, ELENA A. MIKHAILOVA⁴, WILLIAM C. BRIDGES, Jr.⁵ Belmont Abbey College¹, Clemson University², Belmont Abbey College ³, Clemson University⁴, Clemson University⁵ Big bluestem (*Andropogon gerardii*; Poaceae) communities in the Carolinas: Composition and ecological factors

Andropogon gerardii (Big Bluestem) is a dominant grass of the North American tallgrass prairie. It is also found in remnant populations in the eastern U.S., including North and South Carolina, often in association with other species with prairie affinities. We characterized eight A. gerardii population sites across various physiographic regions of North and South Carolina. A total of 362 quadrats (1 m x 1 m) were sampled during the 2006-2008 growing seasons for species occurrence and site and quadrat frequency. Associated species were assigned a commonness index (CI). A Sorenson's Community Coefficient (CC) was used to determine floristic similarities among the sites. In addition, soil samples in three quadrats were sampled at each site at three depths (0-10 cm, 11-20 cm, and 21-30 cm) and analyzed for pH; organic C, and N contents; extractable P, K, Ca, Mg, Zn, Mn; and CEC (cation exchange capacity). A total of 306 vascular plant species were identified comprising 64 families, including 99 (32%) graminoids. There were 61 (20%) Poaceae and 63 (20%) Asteraceae. Species per quadrat ranged from 2 to 7 with a mean of 5. Andropogon gerardii had the highest Cl value (5900), followed by Rubus spp. (1260). CC values were <0.5 for all pairings between sites, indicating high divergence in species composition among even nearby sites. There were 14 rare or watch-listed species identified, including the federally endangered Helianthus schweinitzii at Troy Prairie. A total of 153 (50%) of the species had been previously described as occurring in prairie-like associations. Soil pH values varied among the sites and depths from 4.8 to 6.9. Ca and Mg nutrient values were also highly variable. Andropogon gerardii was found at high frequencies across all sites, indicating its broad tolerance for a variety of edaphic conditions.

O19.9 TIMOTHY. BALDWIN¹ AND YONG WANG¹. Alabama A&M University¹. Relationship of pool breeding amphibian diversity and local and landscape forest cover around temporary wetlands in northern Alabama

Few available studies have examined how the interactions of local and landscape habitat conditions affect reproductive success of pool breeding amphibians. We are currently conducting such a study in northern Alabama at two locations: James D. Martin Skyline Wildlife Management Area and William B. Bankhead National Forest. A total of 24 temporary wetlands were classified to three types based on the amount of canopy cover in the landscape and surrounding the wetlands: open canopy (no trees within 10 meters of the wetland edge), forested (pools surrounded by forests), and perimeter canopy (pools in the open area but surrounded by canopy trees). Biweekly, we sampled amphibians and measured for dissolved oxygen, water pH, soil and water temperature, and the amount of canopy cover at each pool. We have also measured pool area and depth. A geographic information system and remote sensing techniques were used to quantify the terrestrial habitat surrounding the wetlands, and estimate the degree of habitat alteration surrounding the breeding pool. During the first 18 months of this study, we detected a total of 20,036 individuals of 13 species. The most abundant species was Eastern Spadefoot (Schaphiopus holbrookii), which occurred at 25% of the pools. Some species occurred only in a few pools. Amphibian diversity and richness varied by the wetland types, with open wetlands supporting more hylid species, and forested wetlands with more ambystomatid species. Biophysical conditions also differed among wetland types, with

open wetlands having higher dissolved oxygen and water pH than perimeter canopy and forested wetlands.

O19.10 KRISTEN M. KOSTELNIK¹, THOMAS R. WENTWORTH¹, JANET B. GRAY², AND MATTHEW R. HOHMANN³. North Carolina State University¹, US Army – Fort Bragg Military Reservation – Endangered Species Branch², US Army Corps of Engineers – Construction Engineering Research Laboratory³. Interpretation of extinction risk for rare species can be influenced by the choice of model used to characterize population states.

We examined thrice replicated population census data for seven state or federally listed rare vascular plant species endemic to the sandhills region of North Carolina. For each species, we visited all previously known subpopulations on the Fort Bragg Military Reservation, recorded presence or absence, determined number of individuals, and measured spatial extent. We also collected these data at newly identified subpopulations. After completing the three censuses, we identified a total of 469 subpopulations. We applied five population state models to these data to classify each subpopulation as extinct, persistent, or colonized. We also projected possible population states for two future time points. Extinction risk for species and individual subpopulations vary depending on which population state model is used to determine whether a subpopulation is persistent or has gone locally extinct. For example, a two-step model (1991 present -1999 absent) identified 21 subpopulations as extinct that would have been identified as persistent in a three-step model (1991 present -1999 absent - 2008 present). In a comparison of multiple three-step models, we found that 74 out of 469 subpopulations exhibited variation in population state. This finding underscores the important role of population state models in assessing extinction risk and subsequent management decisions.

O19.11 ALLEN C. RISK. Morehead State University. <u>Plant biodiversity surrogacy: a case study from a sandstone gorge ecosystem in eastern Kentucky.</u>

Biodiversity surrogacy is an important practical issue in conservation biology. If the variation in richness of one taxonomic or life form group can be used to predict patterns in richness exhibited by other groups, then biodiversity assessments of multiple potential sites for conservation and protection may be simplified and the time and expense necessary for such assessments reduced. Thirty 10 X 20 m, permanent plots were established in Spaws Creek gorge in the Daniel Boone National Forest in northeastern Menifee County, KY. A stratified study design was employed in which 15 plots were on north-facing and south-facing slopes each. The 15 plots on each aspect included five cliff base, five middle slope, and five streamside plots. Each plot was fully inventoried at the species level for vascular plants twice (spring and summer) during the growing season. Specimens were collected as necessary to ensure accurate identifications and were deposited in MDKY. A total of 184 species was documented for the plots comprising 14 pteridophyte, 113 herbaceous, 14 shrub, 37 tree, and six woody vine species. Herbaceous and woody diversity was significantly correlated for all 30 plots (r=0.581; P=0.001), northfacing plots (r=0.723; P=0.002), and south-facing plots (r=0.632; P=0.011). Herbaceous and pteridophyte richness were significantly correlated for all 30 plots (r=0.716; P<0.001).

O19.12 ALLEN C. RISK. Morehead State University. <u>The partitioning of vascular plant</u> diversity in a sandstone gorge in eastern Kentucky: a mesohabitat approach.

A mesohabitat is a nonrandom association of microhabitats. Within a sandstone gorge ecosystem (Spaws Creek; Daniel Boone National Forest; northeastern Menifee County, KY), three well-defined mesohabitats were recognized: stream, slope between stream and cliff, and cliff. The stream mesohabitat was defined to include the streambed and both

stream banks, the cliff mesohabitat was defined to include the cliff itself and the areas between the cliff and the cliff drip line, the slope mesohabitat included all areas between the preceding two. These three mesohabitats in six tributary gorges (three north flowing; three south flowing) of the Spaws Creek gorge ecosystem were each inventoried for vascular plants during 2009. At least one voucher was collected for each species observed within the gorge system and deposited in MDKY. A total of 317 species was documented (28 pteridophytes, 6 gymnosperms, 72 monocots, and 211 dicots). Mean vascular plant diversity for the stream, slope, and cliff mesohabitats were 72.2, 128.3, and 83.3 species, respectively. Number of species by mesohabitat was not significantly different for north flowing and south flowing gorges. Mean number of species overall per tributary gorge was 166.8. For pteridophytes, gymnosperms, monocots, and dicots the mean values were 19.0, 2.0, 31.8, and 114.0, respectively.

O19.13 DANIELLE PATTERSON¹ and BETSY WILSON². The University of North Carolina at Asheville¹. Soil microbial diversity of a riparian eastern hemlock (*Tsuga canadensis* (I.) carr.) as revealed by 16 S rDNA clone library.

The eastern hemlock is a vital member of southern Appalachian forests, comprising a large portion of the riparian forest system of the region, a system that is very active in maintaining the integrity and safety of drinking water. The eastern hemlock is facing widespread mortality as a result of the wide-spread infestation of the hemlock woolly adelgid. Because the longevity of this keystone species is in question it is now more important than ever to fully describe its habitat. New molecular techniques have made microbial community analysis possible, and it is now understood that a soil's microbial community has a direct impact on the productivity and diversity of the plants that grow in it. The soil of a single riparian eastern hemlock was sampled in order to create a 16 S rDNA library describing the bacterial community associated with it. Total soil DNA was isolated, the 16 S rRNA gene was amplified and cloned. Sequencing of 288 random clones showed the two dominant phylotypes to be Proteobacteria and Aciderobacteria; seventeen of the aligned sequences were unclassifiable. Further sequencing and library comparison should facilitate an understanding of differences between riparian and land-bound eastern hemlock microhabitats.

O19.14 PAUL SUPER¹, KEITH LANGDON², NANCY FINLEY², ROB KLEIN², MATT KULP², KRISTINE JOHNSON², STEVEN MOORE², BECKY NICHOLS², JIM RENFRO², JANET ROCK², SUSAN SIMPSON², BILL STIVER², AND GLENN TAYLOR². Appalachian Highlands Science Learning Center, NPS¹, Great Smoky Mountains National Park, NPS.² Ecosystem monitoring in the southern Appalachians: revisiting long-term monitoring in Great Smoky Mountains National Park and related research.

Desiring to establish a scientific basis for decision-making, the National Park Service (NPS) developed an Inventory and Monitoring (I&M) Program in the early 1990s. Great Smoky Mountains National Park was one of four park units selected as "prototype" parks to test this program. The I&M program has subsequently been established at most NPS units that have significant natural resources, usually through the local network office. While the Smokies' original program has been modified throughout its existence, changes in our understanding of the park's resources, a better understanding of park biodiversity from the All Taxa Biodiversity Inventory, the magnitude and long-term nature of resource threats, and reduced operational abilities make it important to now re-assess the program. We will present a proposed revision of the Smokies' long-term monitoring plan, along with the research opportunities that would assist this program.

O20.1 J. KYLE BOUDREAU. Western Carolina University. <u>Correlates of aggression:</u>

<u>The interplay between tstosterone, boldness, and territoriality in male song sparrows, Melospiza melodia, in urban and rural habitats</u>

Animals colonizing urban habitats are often noticeably bold in the presence of humans, and such boldness is typically thought to arise as urban individuals habituate to the repeated presence of humans. However, recent studies in animal behavior suggest that:

1) boldness is an inherent trait as opposed to a learned behavior and 2) some individuals exhibit behavioral syndromes that restrict behavioral plasticity, a phenomenon that allows individuals to adapt to environmental change. In a recent study, we examined differences in urban and rural populations of song sparrows and confirmed that urban birds were bolder toward humans, but also, this boldness was correlated with higher levels of territorial aggression. In this study, we examined the correlation between testosterone, a hormone associated with aggression in birds, with variation in aggression and boldness in urban and rural song sparrows.

O20.2 JACKSON EVANS AND JEREMY HYMAN. Western Carolina University. <u>An examination of the influence of social information on territory selection by nonmigratory song sparrows (*Melospiza melodia*).</u>

Territory selection in songbirds plays a large role in a species' ecology. Previous studies concluded that habitat was the most important factor for songbirds in selecting a territory, with specific traits in a habitat being sought after when territory quality is variable. However, more recent studies have shown that social information obtained from other individuals in a community plays a large role as well, more so than habitat in areas where habitat quality is consistent. My study examines the influences of social cues on territory selection in a nonmigratory population of song sparrows (Melospiza melodia). This was done by selecting spots on the campus of WCU where there were no song sparrows displaying territorial behavior (defined as the presence of a singing male). During the postbreeding season when juveniles were leaving their parents' territories and prospecting for their own, song was played for 10 hours a day for 10 days to simulate the presence of a male sparrow and potential reproductive success. Point counts were conducted once a month after the treatments to observe for prospecting males and any territorial behavior. Thus far, more males have been seen in the experimental territories that received song than in the control territories that did not. If this trend continues, it will suggest that social information plays a larger role in territory selection than habitat cues.

O20.3 LOUISE PEPPE AND GARY RITCHISON. Eastern Kentucky University¹. Why Twitter? Vocalizations and Displays of Chimney Swifts.

The vocalizations of many songbirds have been well documented and analyzed, but less is known about the vocal behavior of many non-passerines, including swifts. The objective of my study was to determine the function(s) of the vocalizations of adult Chimney Swifts (Chaetura pelagica). I studied swifts at the Blue Grass Army Depot in Richmond, Kentucky, where they use abandoned, concrete shelters for roosting and nesting. Camcorders were used to record swift behavior and vocalizations during the breeding seasons of 2008 and 2009. While flying, swifts emitted a series of high frequency, short duration chip notes, sometimes vocalizing during aerial displays with other swifts (formation-flight calls) and, at other times, when no other swifts were nearby (nonformation-flight calls). Non-formation flight calls were given at the highest rates (3.3 calling bouts/min) prior to female fertile periods. Among nesting stages, swifts uttered nonformation flight calls at the highest rates during nest-building (5.3 bouts/min) and prebuilding (2.6 bouts/min) stages, and at the lowest rates during incubation (0.8 bouts/min) and fledgling (0.3 bouts/min) periods. Calls given during non-formation flights may serve as contact calls and help to coordinate pair activity. Formation-flight calls were given

throughout the breeding season, but at higher rates during female fertile periods (5.4 bouts/min). These results suggest that formation-flight calls play a role in pair formation and reproductive synchronization.

O20.4 MEREDITH CARROLL. Western Carolina University. <u>The use of urban and rural habitats by migrating and residential Song sparrows (*Melospiza melodia*) in western North Carolina.</u>

The majority of bird migration research has concentrated on long-distance movements of obligate migrants. However, populations and individuals of many species are only short distance or partial migrants. Partial migration tendency varies among individuals within a population and between populations. It has been correlated to several factors including gender, age, climate change, and habitat type. This study will focus on the migration behaviors and winter habitat use of two populations of song sparrows (Melospiza melodia) in western North Carolina occupying different habitat types: rural and urban. From May 2009 to July 2009 song sparrows in these areas were drawn in by song playback, caught using mist nets, and banded. This research compares the number of color-banded birds wintering at each site as well as the amount of migrant use. Weekly surveys will be conducted between October 2009 and February 2010. A combination of point source surveys and more invasive methods including beating bushes and giving warning calls will be used. Information recorded will include location, number, and identity of color banded song sparrows and number and location of all non-color banded song sparrows. Early observations in these areas suggest that the urban site has a higher percentage of summer residents that occupy the area year round, and the rural area has a larger number of migrants during late fall and winter months.

O20.5 NICOLE BARRIOS AND LYNN SIEFFERMAN. Appalachian State University. The Effects of Habitat and Nestling Quality on Nest Defense Behaviors of Male and Female Eastern Bluebirds (*Sialia sialis*).

Parents should allocate resources such that they have the highest likelihood of passing their genes to the next generation. Because reproduction is costly, investing in current reproduction can reduce survival and thus reduce residual reproductive potential. The parental investment theory argues that parents will invest their limited resources in the highest-quality offspring. Finally, individuals that breed in high-quality habitats should have more energy for reproduction and thus are expected to invest more energy in young compared to parents in low-quality habitats. We studied nest-defense behaviors of breeding Eastern Bluebirds (Sialia sialis) in two populations: an Alabama Piedmont and a North Carolina Mountain population. We ranked parental defense behaviors (dive, chatter, retreat) towards human researchers approaching the nest of 14 day old nestlings. We measured habitat quality using Natural Vegetation Difference Index, insect sweep netting, and parental provisioning rates to offspring. We used nestling size and coloration as proxies of offspring quality. Because adult female bluebirds have shorter life spans than males, we expected mothers to defend young more aggressively fathers. Contrary to our expectations, males were more aggressive to potential nest predators than were females. Breeding location and habitat quality influenced aggression; parents were significantly more aggressive in higher-quality habitats. Although parents did not defend high-quality nestlings more vigorously than low-quality nestlings, nestlings reared in high-quality habitats were larger and more colorful. Correlations between habitat quality and nest defense suggest that parents may show favoritism towards defending higher-quality young. Future research will test this hypothesis directly with a field experiment.

O20.6 WINTERS, CARLY, ALLISON ROLLINS, AND JENNIFER ZETTLER. Armstrong Atlantic State University. <u>Behavioral interactions between antlions (Neuroptera: Myrmeleontidae)</u> and four species of ant (Hymenoptera: Formicidae).

Pit-building antlions, Myrmeleon mobilis, are predators that construct conical funnels in finely-textured soils to capture prey. These opportunistic predators consume a variety of small invertebrates which they subdue through body thrashing and soil submersion techniques. In our study, we conducted feeding trials to compare and contrast the escape behaviors of four ant species that were presented to antlions and their corresponding prey-capture methods. All species were collected in June 2009 from Savannah, Georgia. We used the native pyramid ant, Dorymyrmex bureni, the native big-headed ant, Pheidole dentate, and two introduced species—the red imported fire ant, Solenopsis invicta, and the fungus-growing ant, Cyphomyrmex rimosus. In laboratory tests, we digitally recorded the interactions between second-instar antlions and ant prey species. We found that the red imported fire ant and the big-headed ant were much more likely to fall victim to antlion predation than the other two species of ant, each of which exhibited distinct escape techniques. Indeed, pyramid ants escaped predation by being able to quickly scale the pit walls. Conversely, the fungus-growing ant escaped predation by appearing to feign death and, accordingly, being thrown by the antlion from the pit unharmed. We did not observe any antagonistic defenses used by any of the four ant species to escape predation.

O20.7 YUANFEI QUAN¹, EILEEN LACEY², LUIS EBENSPERGER³ AND LOREN HAYES¹. University of Louisiana at Monroe¹, University of California, Berkeley², Pontificia Universidad Católica de Chile³. Estimate of fitness consequence of group living in the degu, *Octodon degus*, with Microsatellite.

The fitness consequences of mammalian sociality vary from net benefit to net cost. The "benefit of communal care" hypothesis suggests that benefits of group living outweigh the costs therefore per capita reproductive success should increase with increasing group size. On the other hand, the "ecological constraint hypothesis" suggests that ecological constraints of critical resources limited dispersal and caused natal philopatry. Per capita reproductive success may not differ with increasing group size, or there may be an inverse relationship between the two. We tested these two hypotheses on degus (Octodon degus), a species of plural breeding semifossorial rodents endemic to central Chile. Samples collected from a population of degus including 13 social groups were genotyped with 10 microsatellite loci. Maternity were assigned to 75% of pups with above 80% confidence. The direct per capita fitness of adult females were compared among social groups of various sizes. A negative correlation between per capita direct fitness and group size was observed ($R^2 = 0.2465$), suggesting net reproductive cost of communal breeding. Consistent with previous field observation, our result does not support the "benefit of communal care" hypothesis. Secondly, kin structure was observed in 8 of the 13 social groups suggesting potential natal philopatry. Furthermore, although reproductive skew was considered to be low in communal breeding mammalian species, we noticed significant intra-group difference in direct fitness suggesting potential social dominance and reproductive skew in this plural breeding species. The costs of sociality might not be shared as equally among group members as previously thought.

O20.8 MONICA STEWART¹, LOREN DONALD HAYES¹ AND MAURICIO SOTO GAMBOA². University of Louisiana at Monroe¹, Universidad de Chile, Valdivia, Chile². Intraspecific variation in alarm calls of a social subterranean rodent, Spalacopus cyanus.

Effective signals produced by animals are conspicuous, stereotyped, and redundant, increasing the reliability of the signal to the receiver. In many mammalian species, the characteristics of a signal vary across geographical ranges and can be population-

specific. Geographical isolation of populations of a single species could restrict gene flow which in turn could lead to intraspecific variation in vocalizations. Alarm calls have shown phenotypic variation among geographic range in several rodent species. I propose to examine alarm call features, such as frequency (Hz), intensity (dB) and duration (sec), of coruros (Spalacopus cyanus), a subterranean rodent species endemic to central Chile. The geographical distribution of coruros is widespread throughout central Chile with populations occurring in various. A recent phylogeographic study of seven coruro populations identified three haplotype groups - (1) southern coastal population, (2) central coastal and (3) northern coastal and mountain - indicating low gene flow and high population structure, while body size varies considerably between populations. Given this environmental, genetic, and life history variation, I predict that there is intraspecific variation in coruro alarm calls. To test this hypothesis, I will compare ecological features of coruros in populations located in the coastal (northern, central, and southern) and mountain populations. Determining these and other sources of geographical variations in animal vocalizations contributes to a greater understanding of the evolution of communication systems. Such research linking ecological and anatomical sources of alarm call variation can improve our understanding of proximate and ultimate causation.

O20.9 JEREMY HYMAN¹, JACKSON EVANS¹, KYLE BOUDREAU¹, JENNIFER SCALES², AND MELISSA HUGHES². Western Carolina University¹, College of Charleston². Causes and consequences of variation in territorial aggression in the song sparrow, *Melospiza melodia*.

In many species, the ability to defend a territory is essential for a male to obtain reproductive success. Despite this importance, males can show considerable variation in their strength of territory defense. Variation in the strength of defense could reflect intrinsic differences among males, or strategic adjustment of defense in response to variation in territory quality. We've conducted long term research on song sparrow populations in Pennsylvania and North Carolina in an attempt to determine the source and significance of variation in territorial aggression. Our research has documented consistent individual differences in territorial aggression, with males showing consistent variation in aggression both within and between breeding seasons. Analysis of historical data in a Pennsylvania population suggests that high quality territories are spatially clustered, and that more aggressive males are able to obtain higher quality territories. We've also found that spatial variation in habitat type on a larger scale correlates with variation in aggression, with more aggressive males being found in urban habitats. At present, however, we are still unable to conclude whether the variation in aggression correlated with habitat and territory quality is the result of differential investment by males, or the result of intrinsic variation between males influencing territory settlement.

ASB Poster Abstracts

P1.1 ELLEN WINANT AND WILLIAM ENSIGN. Kennesaw State University. <u>Density and population structure of Elimia spp.</u> snails in streams with differing geology.

We are conducting a year-long study of freshwater snail (Pleuroceridae: *Elimia spp.*) population characteristics in Stamp Creek and Two Run Creek, Bartow County, Georgia. Stamp Creek is in the Blue Ridge ecoregion with metamorphic geology and lower alkalinity (~55 CaCO₃ mg/L), while Two Run Creek is in the Ridge and Valley ecoregion with sedimentary geology and higher alkalinity (~124 CaCO₃ mg/L). One site in each stream was sampled in May, July and October of 2009. Initial results show higher average densities in Two Run Creek (400.4 snails/m²) than in Stamp Creek (54.9 snails/m²). The two populations also exhibit differences in the aperture width frequency distributions. In May and October, Two Run exhibits a bimodal distribution with evidence of strong recruitment of the new year class in the October sampling event. Although there is some

evidence for a bimodal distribution in Stamp Creek in the October sample, there is no clear distinction between year classes in either the May or July samples. Our results are consistent with hypothesized differences in *Elimia* growth characteristics associated with increased productivity in the Ridge and Valley ecoregion.

P1.2 MICHAEL DAMRON, KYLE STOWE, WADE HOLCOMB, LINDSAY BROTHERTON, AND THOMAS NELSON. North Georgia College and State University. Influence of local land-use on stream fish communities in north Georgia.

Aquatic biodiversity is high in the streams of north Georgia, but this region is experiencing unprecedented exurban growth and urban development. To investigate the relationship between local land use and fish communities in headwater streams, we analyzed the relationship between sub-watershed land use and two measures of stream quality, the Index of Biotic Integrity (IBI) and the Index of Well-Being (IWB) at 10 sites along 5 first-and second-order streams in the Chestatee River watershed. Sites were classified as urban, agricultural, or forested based on the predominant land-use in each sub-watershed. We hypothesized that both indices would decline from forested to urban sites. A total of 906 fish of 25 species was processed during the study. Based on a composite of both indices, forested sites were usually good-excellent, agricultural sites were highly variable, and urban sites were fair-poor. Although sample sizes were small, our data suggest that increased intensity of local land use alters the composition of stream fish communities, lowering biotic integrity.

P1.3 JAMES REECE AND WILLIAM ENSIGN. Kennesaw State University. <u>Fish</u> species richness and urbanization in North Georgia streams.

Rapid suburban development has led to what is called an "edge city" where forest and agricultural land has been converted into decentralized employment centers and sprawled housing developments. Suburban area development increases the area of impervious surfaces, leading to altered patterns of storm water runoff that can increase stream bank erosion and negatively impact stream fish habitat. Using ArcGIS we hope to show a spatial relationship between different land use types, species richness and presence of intolerant species in stream fish populations. Species richness estimates have been obtained from over 80 sample sites in the Etowah, Chattahoochee and Tallapoosa River basins. We will map patterns of urbanization inside the watershed areas upstream of sample sites and compare that to species richness to investigate the effects of urbanization in North West Georgia on fish assemblages.

P1.4 ELSPETH SAWYER, CAYLA BEST, AND ALAN F. SMITH. Department of Biology, Mercer University, Macon, GA 31207. <u>Preliminary characterization of the phenomenon of invertebrate drift in a Middle Georgia stream</u>.

In the process of invertebrate drift, aquatic stream invertebrates leave the benthic layer and drift in the water column until deposited to a new site, usually just a few meters downstream. Multiple hypotheses have been proposed to account for this behavior, including reducing competition, escaping from predation, and maximizing dispersal. Previous studies have revealed that the pattern of invertebrate drift often exhibits a species-specific diel periodicity with sunrise or sunset serving as the entraining photoperiodic cue. The goal of this pilot study was the identification of potential diurnal patterns of invertebrate drift among the predominant macroinvertebrates in a typical, benthic-resource-limited Middle Georgia stream. On June 21, 2009, six Surber samplers were arranged linearly within a rocky riffle area exhibiting a fairly uniform flow rate and depth in Walnut Creek (Bibb Co., GA). Three collections were taken from each site after a 2 hour period of sampling starting 1 hour before sunrise, 1 hour before midday, and 1 hour

before sunset. The 18 samples were immediately preserved in 70% ethanol for later laboratory analysis. Macroinvertebrates from each sample were subsequently identified to the family level. Chironomids clearly comprised the majority of the drift community (>70%), with the Ephemeroptera and Plecoptera encompassing the only significant remainder. The difference in densities of invertebrates comprising each family at the 3 collection times was compared to determine a marked pattern of diel periodicity to warrant further study.

P1.5 JESSICA KIDDER, ISABEL MOORE, CARLY BYERS, COLLEEN BROOKE, ABBIE M. TOMBA, AND CHARLES WHIPKEY. University of Mary Washington.

The effects of acid mine drainage on water quality and macroinvertebrate diversity and abundance in Contrary Creek, Louisa Co, Virginia.

Contrary Creek receives drainage waters from abandoned gossen, pyrite, and gold mines, and is considered one of the most polluted streams in Virginia. Acid mine drainage (AMD) is associated with high acidity, increased turbidity, precipitation of iron hydroxides, and elevated concentrations of heavy metals, Our objective was to determine the relationship between macroinvertebrate abundance and diversity, and the physicochemical habitat variables resulting from AMD. Impaired water quality from AMD is hypothesized to cause a decline in macroinvertebrate abundance and diversity. Stream profiles were prepared at 15 sites within Contrary Creek and 4 sites from its tributaries. We measured habitat parameters including conductivity, temperature, pH, and water velocity at each site. Water chemistry, sediment, and macroinvertebrate samples were collected at each site. Macroinvertebrates were assessed by collecting 3 surber samples in both riffle/run and pool habitats at each site. Macroinvertebrates were preserved in ethanol, identified to family, and diversity was calculated using the Shannon-Weiner Index. Preliminary results showed that the pH ranged from 2.94-5.57 and conductivity ranged from 31.4-984 µS. Chironomid larvae dominated the macroinvertebrate assemblage with odonate nymphs also present but less abundant.

P1.6 LISA BONNER, PATRICK MYER, AND REBECCA HAILEY. Peace College. Effect of periodic flooding and drought on macroinvertebrate community structure in lotic ecosystems.

The original objective of this study was to determine seasonal fluctuations in invertebrate community structure within Crabtree Creek (Wake County, NC). However, typical seasonal variations were overshadowed by periodic scouring effects of floods punctuated by occasional drought conditions. We consequently documented community composition, species diversity, resilience, and recolonization in benthic macroinvertebrate densities that were subjected to these dramatic fluctuations in stream depth and flow. Benthic macroinvertebrates were collected by standard methods for a total of 3 man-hours immediately before and after heavy rains from pool, run, bedrock, undercut banks and riffle habitats in the main channel of the creek to test whether specific habitats provided flow refugia to the biota. While overall macroinvertebrate densities did not show statistical differences among sample dates, abundance of certain species varied dramatically across all habitat types, and the percent reduction appeared to be related to flood magnitude. Refuge seeking behaviors, flexible life histories and effective recolonization mechanisms enabled the biota of Crabtree Creek to persist and recover from these frequent, temporally unpredictable disturbances, only to be decimated after subsequent flood events. Additional stressors to organisms include the periodic drought conditions, which left numerous habitats desiccated. Physicochemical parameters (including stream depth, width, velocity, dissolved oxygen, and pH) were measured in addition to a number of biotic indices such as species diversity, abundance, richness and pollution tolerance values all of which showed temporal fluctuations in response to alternating flood and drought conditions.

P1.7 CASEY LOVELADY. Piedmont College. The Influence of Aqueous Phosphate and Nitrogen Solutions on the Survivability of *Hyalella azteca*.

A two-month long study assessing the survival rates of a specific arthropod, Hyalella azteca, when exposed to three different concentrations of phosphorus and nitrogen was preformed. Unlike most studies that deal with the addition of these nutrients with respect to algal growth and subsequent impact on aquatic systems, this study aims to assess the direct effect of these nutrients in an aqueous solution on macro-invertebrate survivability. A common water-soluble plant fertilizer (Mircle-Gro 24-8-16) was diluted appropriately into 2,000 mL beakers. Prepared solutions consisted of three concentrations: the low concentration contained 0.3- 0.5 ppm of nitrogen and 0.5-0.7 ppm phosphate (P₂O₅), the medium concentration 0.5-0.7 ppm of nitrogen and 0.6-0.8 ppm of phosphate (P₂O₅), and the high concentration 0.8-1.0 ppm nitrogen and 0.8-1.0 ppm phosphate (P₂O₅). Fifty H. azteca were split up evenly between ten 250 mL beakers vielding five replicates with five individuals per replicate. For each exposure a control group consisting of the same set up was maintained for the duration of the experiment. The arthropods were set up in the beakers for one full week with a consistent feeding routine. At the end of the term the surviving and deceased organisms were extracted and counted to note the survival rate of the Hyalella azteca. Statistical analysis of the data gathered showed that all concentrations do impact survivability when compared to the control group, and although the lowest concentration did show a departure from the control some organisms did survive at low concentrations. However, at the intermediate and highest concentrations survivability is significantly impacted. In previous studies that closely resemble this one they look at how the nutrients indirectly affect the survival rate of the H. azteca due to algal blooms, but in this particular study the direct effect of these nutrients diluted in water is what was examined.

P1.8 ASHLEY WRIGHT AND MAYNARD SCHAUS. Virginia Wesleyan College. Effects of Diet on Gut Morphology of Gizzard Shad.

In fish, planktivorous and omnivorous species vary dramatically in intestine length. Omnivores typically have intestines that are 2-4 times the body length, whereas planktivores typically have much shorter intestines. Longer intestine length can help omnivores assimilate lower quality vegetative and detrital foods. Previous studies indicate that the diet of the omnivorous gizzard shad (Dorosoma cepedianum) can vary substantially among lakes, making this species ideal for examining the relationship between diet and intestinal morphology. We examined the diet and gut morphology of Gizzard Shad from five lakes, four from Florida (Apopka, Dora, Griffin and Newnans) where gizzard shad exhibit higher growth and feed on a mixed diet and one from Ohio (Acton), where gizzard shad are typically detritivorous and exhibit lower growth. We hypothesized that intestine length would be shorter in systems where gizzard shad fed more extensively on zooplankton. Relative intestine length was significantly shorter for Lake Apopka, which had the highest observed planktivory, compared to the longer intestine lengths observed in Lake Dora, one of the lakes with lower levels of planktivory. Acton Lake gizzard shad showed a nonsignificant trend toward a longer intestine length when compared to Florida gizzard shad of similar size, however this comparison was hampered by the small sample size from Acton Lake. Future studies will examine additional fish from Acton Lake and will add gizzard shad from Lake O neida, NY, where fish have been observed to rely heavily on zooplankton.

P1.9 PRIYA BHAVAN, DHARTI PATEL, MARK MEADE, JOSH TURNER, and RICHARD WATKINS. Jacksonville State University. The use of microsatellite markers to examine genetic diversity in the Alabama Holiday darter, Etheostoma brevirostrum.

The Alabama Holiday darter, Etheostoma brevirostrum, is endemic to Shoal Creek in the Talladega National Forest. Several other populations of Holiday darters exist in the Coosa River system in NW Georgia and in SE Tennessee. In Alabama's Shoal Creek, at least three metapopulations have been identified. Several large impoundments are located along Shoal Creek and may limit the interaction among the Alabama populations. Limited information exists on the genetic diversity of this imperiled species. We report here the use of microsatellite markers to examine the genetic diversity of the Alabama metapopulations. Several microsatellite markers have been used successfully to identify the genetic diversity of Alabama Holiday darter congeners. DNA samples were extracted from Alabama Holiday darter tail clippings using the QiagenÔ DNA easy extraction kit. Samples were then quantified and used for fragment analysis. Microsatellite DNA fragments were created using a modified M-13 tailed PCR reaction. Following PCR, the fragments were analyzed using the Beckman-Coulter fragment analysis system (CEQ 8000). Microsatellite fragments produced for Holiday darters were consistent with fragments produced for its congeners. Preliminary analysis indicates that genetic diversity among the Alabama populations may be limited.

P1.10 EMILY TRIPP, JORDAN LYERLY, MIN-KEN LIAO, AND GREG LEWIS. Furman University. The impact of urbanization on bacterial community compositions in watersheds of Upstate South Carolina.

Streams draining urban areas have increased nutrients and pollutants and lower macroinvertebrate and fish diversity. However, little is known about the impact of urbanization on bacterial community composition. In this study, we investigated the community compositions of antibiotic-resistant (ABR) bacteria in Brushy Creek (BC), a stream draining a commercial watershed, South Pacolet River (SPR), a stream draining a residential watershed, and Middle Saluda River (MSR), a stream draining a forested watershed. Additional commercial, residential, and forested samples from watersheds throughout upstate South Carolina were also analyzed. The fecal indicator bacteria concentrations in all samples were determined. Water samples were filtered through 0.45µm membranes. The diversity of 431 bacterial isolates from different sampling sites was analyzed by the restriction pattern (ImageJ) or the sequences of 16S rRNA genes (BLAST). Fecal indicator bacteria were quantified using IDEXX's Colilert and Enterolert kits. Our data showed that the concentrations of fecal indicator bacteria were greatest in BC, followed by SPR and MSR. Additionally, samples from residential areas throughout upstate South Carolina had greater concentrations of fecal indicator bacteria than those found in samples from commercial areas. There was a greater abundance of ABR bacteria in BC, followed by SPR and MSR. However, there was greater diversity in ABR bacteria in MSR than either BC or SPR. Similar ABR bacterial profiles were seen in commercial, residential, and forested samples throughout the upstate. Our research suggested that urbanization produces increased abundance and decreased diversity in antibiotic-resistant bacterial community.

P1.11 AMANDA SMITH, TOMMY JACKSON, GEORGE MCMULLAN, RYAN OREAR, AND NANCY EUFEMIA DALMAN. North Georgia College and State University, Dahlonega, GA. <u>A comparison of Escherichia coli levels in the Chattahoochee River between drought and non-drought years</u>.

The Chattahoochee River, which flows through Helen, Georgia, is a popular summer recreational site. Studies have been conducted in both drought and non-drought years on *Escherichia coli* levels in the water before and after peak recreational use. Recreational river use may lead to increased levels of bacteria due to sediment disruption and dispersal of bacteria that aggregate in the soil. Water samples were taken at five recreational sites in town and at five pristine non-recreational sites in the Chattahoochee National Forest, on days with highest volume of recreational users, from late June to the middle of September.

E. coli were quantified using the Colilert® Quanti – tray® 2000 system (IDEXX), and the results from summer 2009 (a non-drought year) were compared with those from summer 2007 (a drought year). E. coli levels were significantly higher at recreational sites as compared to non-recreational sites for both years. However, no significant difference in E. coli counts existed between morning and evening samples in 2009, but in 2007 E. coli levels were higher during the evening after peak recreational use. Further, evening sampling at recreational sites displayed a correlation between suspended sediments and water – borne E. coli levels in 2007 but not in 2009. This incongruence between years has led us to the conclusion that sediment bacteria, in non-drought years, are more dispersed in the water due to the higher water volume. These results indicate that recreational river users are exposed to higher water – borne E. coli levels during drought years than during non-drought years.

P1.12 JORDAN LYERLY, EMILY TRIPP, and MIN-KEN LIAO. Furman University. Using *Bacteroides* DNA to track the source of fecal contamination in waters: proving a method.

The conventional method of using E. coli and Enterococcus sp. as indicator organisms for fecal pollution in waters is straightforward, cost-effective and rapid. However, they fail to indicate the source of the animal host because they are not host specific. Recently, research has shown that Bacteroides sp. is a better source-tracking indicator organism. Unlike E. coli, however, Bacteroides sp., an obligated anaerobe, cannot be easily studied using conventional culturing method. To detect the presence of Bacteroides in water, sets of Bacteroides specific PCR primers were used. In this study, we optimized and streamlined procedures using waters from the biotic/aggregate filtration systems on Furman campus. DNA in water samples from different stages of filtration systems was extracted and analyzed with endpoint and quantitative PCR (SYBR green and TaqMan) to determine the presence of Bacteroides sp. For each sample, two sets of primers, one to amplify total Bacteroides of all animal origins and one to amplify human-specific Bacteroides, were used for endpoint and quantitative PCR (SYBR green and TaqMan). Our data showed that for both total Bacteroides and human Bacteroides, the detected amount of the bacteria was highest in the untreated raw sewage and that it was lowest in the last stage of water treatment for both endpoint PCR and quantitative PCR. The general trend is that the quantity of Bacteroides DNA decreased with treatments. Current research is focused on analyzing waters of different land use-urbanized, rural and forested areas—in the watersheds of upstate South Carolina.

P1.13 RYAN OREAR, AMANDA C. SMITH, NANCY EUFEMIA DALMAN, NORTH GEORGIA COLLEGE AND STATE UNIVERSITY. The persistence of riverbed sediment bacteria stores and the disruption by human recreation.

Disturbance to riverbed sediments from recreation allows for *Escherichia Coli* to become elevated in the water column. To illustrate the role that sediment bacterial stores have in water-borne contamination, three experiments were performed. The first test was a field based bacterial sediment and water comparison. Water and sediment samples were collected mid – stream during the summer at five distinct locations using sterile containers. In all comparisons, sediments displayed greater levels of *E. coli* then water, suggesting that sediments act as a sink for river bacteria. The second test was a sediment disturbance test. This field based experiment observed the water – borne concentration of *E. coli* after an induced disturbance to riverbed sediment. A 2m² riverbed plot was disturbed and water samples were collected over time 10 meters downstream of the disturbance. This test indicated that disruption of sediment transiently increased water *E. coli* concentrations. The last test was a laboratory based microcosm persistence experiment. Ten samples received ten grams of sterile sediment plus100ml of sterile water and the other ten samples only received 100 ml of sterile water. All samples were

inoculated with known concentrations of *Escherichia coli*. Preliminary results indicate that *Escherichia Coli* persist for longer periods of time in the presence of sediment than in water alone. *Escherichia Coli* in all experiments were quantified using the Colilert ® Quanti – tray 2000 system (IDEXX). These results demonstrate that sediments store bacteria for extended periods and as human recreation increases, so does the risk of humans contracting a water-borne infection.

P1.14 RENEE D. GODARD, C. MORGAN WILSON, AND DENAE N. LOBATO. Hollins University. Eastern Bluebirds (Sialia sialis) avoid nest boxes with predator guards.

Predation is the primary source of nest failure in birds and may be one of the dominant forces that drives nest site selection. The Noel nest box predator guard was designed to reduce mammalian predation on species that use nest boxes, but little information exists on the guard's impact on nest site selection. Therefore, we conducted a series of choice experiments from 2006-2009 to determine if Eastern Bluebirds (Sialia sialis) choose boxes with predator guards. When presented with a choice between boxes with Noel guards and those without, in both 2006 (N=14) and 2009 (N=6), bluebirds showed a significant preference for boxes without guards (2006, P=0.002; 2009, P=0.031). Our behavioral observations indicated that bluebirds would often perch on the box opening before entering the cavity, and that the guards made this behavior difficult. Therefore, in 2007, we removed the bottom panel of the guard to allow for more normal perching behavior. Bluebirds that were offered a choice between boxes with a modified guard and no guard showed no preference (2007 N=9, P=1.0). In the following year, bluebirds were offered a choice between boxes with a modified guard and those with a complete guard. Again, birds showed no preference (2008 N=10, P=1.0). Our results suggest that bluebirds avoid nest boxes with Noel predator quards. Consequently, the benefits and costs of such predator guards should be further evaluated, as attaching guards to boxes to reduce predation may actually result in a population shift or decline if bluebirds seek alternative, less suitable habitats.

P1.15 EDWARD MILLS. Wingate University. <u>The effects of sound masking on the crow</u> call of Blue-breasted Quail (*Coturnix chinensis*).

Human-generated noises have been shown to affect avian communications in a number of ways. Some bird species respond by changing the frequencies they produce to decrease sound masking that may occur. Others simply increase the call volume (Lombard effect) in order to be heard in the presence of anthropogenic noise. Some species do both. Adult male Blue-breasted Quail (Coturnix chinensis) produce a short (0.6 sec), one-syllable crow as a territorial and courtship call, and can be stimulated to produce this call by song playback. The crow call consists of two distinct frequency bands: Band1 is 870.25 - 1595 Hz; Band2 is 1901.57 - 3147.04 Hz. In order to assess the impact of human-generated noise on adult Blue-breasted Quail, targeted sound files were created at 70 and 75 dB that mask each of these bands. Crow calls were recorded and measured for low and high frequency (Hz), band width and average power (dB). Comparisons with control birds (not exposed to noise) demonstrated that sound masking caused Bluebreasted Quail to modify their communications. The experimental group altered the frequencies of both crow call bands away from the sound-masking noise, and elevated the call volume to reduce sound masking. These effects were most significant when the quail were exposed to noise at the higher volume (75 dB). The potential ecological and behavioral (sexual selection) effects of these changes may be significant, but are currently unknown.

P1.16 ALEXANDER KOHORST, CHRISTOPHER HILL. Coastal Carolina University.

Post-fledging survival and colony attendance of Least Terns (Sternula antillarum): a comparison of rooftop and natural colony sites.

In the southeastern United States, most Least Terns nest either on gravel rooftops or on sand, gravel, or shell beaches. Young terns that fledge from rooftops may face different challenges than terns fledging from beach sites. The purpose of this study was to investigate whether survival rates, colony attendance, and fledgling residency times of post-fledging Least Terns differed between a rooftop colony in Conway, SC and an oyster-shell-bank colony in Bulls Bay, SC. Yong terns were equipped with radio transmitters prior to achieving flight. At each colony, dataloggers were placed to record presence or absence of marked terns. Survival calculations of the marked terns were based on data collected by the dataloggers and by field tracking using Yagi antennas and receivers. Kaplan-Meier survival estimates to 42 days of age for the two colonies were 0.39 (rooftop) and 0.52 (natural). Ages at departure from the colonies were as follows: rooftop colony: 38 +/- 2.53 days, range (33-48), natural colony: 41.5 +/- 1.19 days, range (39-44). No significant differences in survival or patterns of colony attendance between the two colony types were found in 2009. Problems associated with radio transmitter attachment to juveniles and possible causes of mortality will be discussed.

P1.17 ALEXANDRA BENTZ AND LYNN SIEFFERMAN. Appalachian State University. Influence of social stress and female quality on offspring fitness in Tree Swallows, *Tachycineta bicolor*.

An individual's phenotype is determined not only by genes and environment, but also by those of its mother, called the maternal effect. In bird species, the embryo develops externally and egg hormonal provisioning, or yolking, is an important time in which the mother can exert this maternal effect. During yolking, the female produces androgens that are transferred to the egg yolk by steroidogenic cells in the follicle wall of the ovary. Mothers directly influence offspring fitness by depositing varying amounts of androgens in the eggs. Females have been demonstrated to deposit more androgens in yolk than control females when subjected to more aggressive conspecific interactions during egg laying. In many species, elevated yolk androgens increase nestling growth rates, but they may experience reduced immunocompetence. Many studies have artificially increased yolk androgens by injecting hormones into eggs; to date no study has manipulated yolk hormones by increasing female aggression and then measuring offspring fitness in a wildbreeding bird species. We experimentally manipulated female aggression in tree swallows, Tachycineta bicolor, using simulated territorial intrusions to raise yolk androgen levels naturally and consequently measured offspring fitness using growth rate, begging rate, and immunocompentence assays. Although we found no effect on the experimentally manipulated social stress of mothers on offspring fitness, we are currently exploring whether other factors, specifically nesting density, habitat quality, and female quality influence offspring fitness.

P1.18 JUSTIN MARTIN AND KIM MARIE TOLSON. Department of Biology, College of Arts and Sciences, University of Louisiana at Monroe. Wood duck nest box management based on nest success data and geospatial analysis.

Artificial nest-boxes were first used in 1937 to provide alternative nesting sites for wood ducks (*Aix sponsa*). Since 1990, the Louisiana Department of Wildlife and Fisheries has maintained and monitored nest boxes to supplement natural cavity nesting sites for wood ducks. During this study, 141 boxes were surveyed—67 were located in/around Wetlands Reserve Program land, 36 were located in/around bottomland hardwood forests, and 38 were located in/around a mature mixed bald cypress and water tupelo brake. Nest-boxes were checked bi-weekly from Feb 2008 to Aug 2008, and then again monthly from Feb

2009 to Aug 2009. Variations in clutch size, nest initiation, nest success, and nest-box utilization were recorded. The average clutch size of WRP was 12.67 ± 2.94. The average clutch size for BLH was 12.84 ± 3.14. CWT had an average clutch size of 13.03 ± 3.42 eggs. The first nest initiation in this study was 11 Feb 2008, which is the earliest documented nest initiation on record in LA. WRP had the highest percentage of successful nests. Average nest box utilization for WRP was 42.2%, BLH 30.2%, and CWT 23.1% during the study. Nest predators and other animals that utilized the boxes were also documented. A base map of the study areas was constructed using ARCMAP GIS. Additionally a land use/land cover map of the study areas was created to diagram the current nest-box placement of the study areas. Nest-box data along with the mapping data will be combined to develop a strategic plan for wood duck nest-box management in Louisiana.

P1.19 LEAH M. GOOD AND H. DAWN WILKINS. University of Tennessee at Martin. Species diversity of woodpeckers in a water tupelo swamp and a bottomland hardwood forest in northwest Tennessee.

As primary cavity nesters, woodpeckers fill an important niche in forested ecosystems because they provide cavities for secondary cavity-nesting species and help control the population of harmful insects. The diversity of trees in a particular forest may influence the abundance and diversity of woodpeckers present. Our goal was to compare woodpecker diversity between a water tupelo swamp and a bottomland hardwood forest in northwest Tennessee. We set up five, 200 m, fixed-radius points approximately 250 m apart in each habitat. To increase detection of woodpeckers, we used a 10 sec Barred Owl (Strix varia) playback at the beginning of each minute of the 3-min observation period. A diversity rarefaction was run on the total abundance of each woodpecker species from each habitat type to determine if the two areas were equally diverse. Preliminary data showed that the bottomland hardwood forest was more diverse than the water tupelo swamp. We observed three species in the swamp compared to six species observed in the bottomland. The species observed in both habitats tend to forage on a variety of food sources, whereas, the species found only in the bottomland have more specific habitat needs that are likely met by the diversity of tree species found in this habitat. Based on this preliminary study, further description of the species composition of each area may lead to a better understanding of the relationship between tree diversity and the needs of particular woodpeckers.

P1.20 MATT PARDUE AND KIM MARIE TOLSON. Department of Biology. Nest-site selection of dickcissels (Spiza Americana) across four locations in northeast Louisiana.

Grassland birds have experienced some of the sharpest declines of any birds in North America. One grassland species, the dickcissel (*Spiza americana*), is listed as a species of concern by the Cornell Lab of Ornithology and Partners in Flight (Rich et al., 2004), and has been placed on the Audubon Watch List. The dickcissel is a neotropical migratory bird that once utilized vast grassland and prairie habitat for foraging and nesting purposes (Weidenfeld and Swan, 2000). The Cornell Lab of Ornithology lists several conservation concerns for the dickcissel. The dearth of knowledge of nesting ecology and nest predation is one such concern. With the loss of prairie habitat, dickcissels are now found in a wide range of habitats, particularly in lands enrolled in federal programs, such as WRP, CRP, and CREP. These programs provide early successional habitat for the first few years of enrollment. However, after several years, plant succession occurs, allowing for larger trees to take over, shading out low growing forbs and grasses. Nest searches were performed from the beginning of May through early August in 2008 and 2009. A total of 200 dickcissel nests were located on two WRP fields in Ouachita Parish, as well as one

CREP, and one WRP field in Richland Parish. Nests were monitored every 4-5 days to ascertain nesting success.

P1.21 KALIA MILLER AND RENEÉ E. CARLETON. Berry College. <u>Fecal mass of nestling eastern bluebirds (Sialia sialis)</u> reared in wooden nest boxes decreases in response to increasing nest box temperature.

Fecal sacs were collected from nestling eastern bluebirds (*Sialia sialis*) reared in wooden nest boxes in order to evaluate nestling response to changes in nest box temperature. Samples were collected at approximately 8am and 3pm during the months of June and July. Samples were weighed, dried at 121° C for 24 hours, and re-weighed after drying. Nest box temperatures were recorded at each sampling occasion using a hand-held infrared thermometer. Mean morning and afternoon nest box temperatures were significantly different; morning temperature mean was 24.3° C (range 16.38 - 28.7) and afternoon temperature mean was 33.8° C (range 27.12 - 38.77). Both wet and dry fecal mass decreased with increasing nest box temperature. For most of the fecal sacs collected in the afternoon, the difference between wet fecal mass and dry fecal mass was less for nest boxes having a 10° C or greater difference between morning and afternoon temperatures than for nest boxes with a less than 10° C difference. These results suggest that nestlings respond to increasing nest box temperature by reducing fecal sac water content.

P1.22 KELLY GRONEMEYER¹, RALPH SAPORITO², AND MEGAN GIBBONS¹. Birmingham-Southern College¹, Old Dominion University². Avian attack rates on models of juvenile and adult sizes of aposematic and palatable frogs.

Both warning coloration (i.e., aposematism, indicating unpalatability) and large body size are associated with increased conspicuousness to predators. These findings suggest that large, brightly colored individuals emit a stronger warning signal than small individuals with similar coloration. If body size in aposmematic species is positively related to toxicity, it is advantageous for predators to associate large body size with low palatability, and small individuals should receive more predator attacks than larger individuals. On the other greater conspicuousness in palatable, cryptically colored disadvantageous, such that large individuals should receive more predator attacks than smaller individuals. We conducted an experiment at La Selva Biological Station in Costa Rica using different sized models of the aposematic Oophaga pumilio (strawberry dartpoison frog) and frogs of the genus Craugastor (a common palatable species) to determine if color and body size influenced avian attack rates. Large and small models (representing the coloration patterns of O. pumilio or Craugaster were placed throughout secondary forests; the models were then collected and examined for markings that indicated predation attempts. Color did not influence predator attack rates. However, size did have a significant effect: more brown adult than brown juvenile models were attacked, suggesting that an increase in conspicuousness of cryptic species increases predation rates. Further research should investigate the relationship of toxicity and body size in aposematic species.

P1.23 STEVEN WILKENING, LAINY DAY AND JOHN BALL. The University of Mississippi. <u>Avian cerebellum specialization in relation to acrobatic courtship displays in manakins (Pipridae)</u>.

The courtship displays of male manakins (Pipridae) involve an array of acrobatic and postural elements. One might expect species with more elaborate displays to exhibit specializations in motor planning and coordination areas of the brain. Several studies have suggested a relationship between cerebellum (Cb) morphology and distinct motor-related functions for the anterior Cb (somatosensory, flying, hopping/walking), posterior

Cb (vision, audition, flying, hopping/walking and vestibular), vestibuloCb (flying, hopping/walking, vestibular), and cerebellar nuclei (CBN; Cb output). Therefore, we compared Cb morphology of four species of manakins: Manacus vitellinus, Pipra mentalis, Chiroxiphia lanceolata, and Lepidothrix coronata, representing a range of display complexities. We scored each species's display for overall complexity, taking into account acrobatic elements and the presence of sound production by the wings or coordination between two displaying males. We then tested for a correlation between display complexity score and area of the midsaggital Cb, the length of the Purkinje cell layer for anterior Cb, posterior Cb, vestibuloCb, and lastly the volume of combined CBN (L. coronata not included in CBN analysis). Such relationships would point to specializations related to the function of Cb regions. Kendall t correlations were performed for display complexity score versus residuals from In-AreaCB (vs. In-brain weight), size of the anterior Cb, posterior Cb and vestibuloCb. No relationship was detected with this sample size. Results from linear regression of display complexity and CBN volume suggest a significant, strong relationship. Therefore, Cb outputs could have a greater impact on behavior in species with more complex displays.

P1.24 KATE LYN SHEEHAN^{1,2}. Clemson University1, South Carolina Cooperative Fish and Wildlife Unit². <u>Intestinal parasites of the double-crested cormorant</u> (*Phalacrocorax auritus*), in northern Alabama.

The intestines of over 100 double-crested cormorants (Phalacrocorax auritus) collected from Lake Guntersville, Alabama were assessed for disease and parasitic infection. Abnormal appearance of tissues, fat content, and eukaryotic parasites were documented for young of the year, sexually immature adults (over 1 year old), and sexually mature adults. Parasites from two phyla (Platyhelminthes [digenean trematodes] and Nematoda) were commonly found. Ectoparasitic arthropods were also collected from the digestive tract, although their presence was likely due to ingestion during grooming activities. One strigeatoid (Diplostomatidae) trematode, four echinostomes (Echinostomatidae and Psilostomatidae), and one opisthorchiid (Heterophyidae) were identified from intestinal contents with two species of *Drepanocephalus* sp. (Echinostomatidae) occurring most frequently. The nematode Capillaria sp. was commonly found, and Contracecum sp. was also observed in many specimen, although occurrences of the latter are suspected to be a dissection-associated anomaly. Relationships between parasite variables (abundance, richness, and relative biomass) and intestinal fat content (proportion of biomass) will be explored for different age and sex covariates. Implications of parasite infections on body condition of the double-crested cormorant will be discussed in light of the ecology of each parasitic species.

P1.25 RACHAEL HOCH¹, MICHAEL A. GANGLOFF¹, BYRON HAMSTEAD¹, AMY SILVANO², and JAMES B. GRAND². Appalachian State University¹, Alabama Cooperative Fish and Wildlife Research Unit². <u>Update on Crayfish Sampling with the Alabama Inventory and Conservation Planning Project in 2008 and 2009</u>.

In 2008, we began a 3-year systematic inventory of freshwater crayfish and mollusk populations on 15 state managed lands in Alabama. In 2008, we targeted 4 properties in southern Alabama (Barbour, Perdido and Stimpson Wildlife Management Areas, WMAs, and Gulf State Park). In 2009, we targeted 6 properties in central Alabama (Cheaha, Oak Mountain, and Wind River State Parks and Coldwater, Coosa, and Sipsey WMAs). We stratified sampling by selecting 10 reaches per stream order on each property. We sampled 3 primary stream meso-habitats (riffle, run, pool) for crayfish using baited traps left overnight. During 2008, we collected 689 crayfish (14 taxa) from 86 sites on 4 properties. In 2008, crayfish richness was greatest on Stimpson WMA (10 taxa total) while abundance was highest on Coosa WMA (CPUE= 3.14 per trap night). Both crayfish abundance and richness were lowest on Perdido WMA (mean CPUE = 0.29 per trap night).

2 taxa total). In 2009, we collected 1170 crayfish from 98 sites on 7 properties. Crayfish abundance was highest on the Sipsey WMA (CPUE = 3.94 per trap night) and lowest on Coldwater WMA (CPUE = 0.09 per trap night). Highest encounter rates for crayfish were in 2nd and 3rd order streams. Very few crayfish were captured in 5th or 6th order streams and may reflect increased predator abundance in larger streams or sampling gear bias.

P1.26 ROBERT L. HOPKINS II. University of Rio Grande <u>A multi-scale approach for selection and management of freshwater protection areas for fish and mussel conservation.</u>

Freshwater fish and mussel diversity is being lost at an alarming rate across North America. Human land uses and disturbances within watersheds have been implicated as the primary cause of decline, resulting in degraded stream habitats. Despite extensive documentation of threats, strategies for the conservation of aquatic systems remain chronically under-developed. In this paper, a landscape-based multi-scale approach for developing freshwater fish and mussel conservation areas is presented. Distribution and species richness models were developed for 24 rare fishes and mussels from the upper Green River system (Ohio River basin, USA) using multi-scale landscape data and boosted regression tree analyses. Land use/land cover composition and pattern, geology composition, and soil composition data were used to build the statistical models. We then used probability of occurrence, endemicity, prevalence, trend, and range of individual species to estimate the conservation value of each stream reach. Freshwater protection areas were defined at three spatial scales: reach buffer zones, riparian buffer zones, and subcatchment zones. Reach buffer zones were selected based on a threshold value which designates 15% of the stream reaches for conservation. Other conservation zones were selected based on a threshold value which designated 7.5% of stream segments for conservation. Lastly, species richness models are used to investigate landscape management strategies by examining response curves to land use/land cover variables. The analyses revealed area selected for conservation occurred in clusters across the watershed. Species richness responded positively to increases in forest cover at each spatial scale and negatively to increases in landscape fragmentation.

P1.27 SABRINA SHRADER AND NANCY BUSCHHAUS. University of Tennessee at Martin. The effects of direct ultraviolet radiation on early development of the green sea urchin, *Strongylocentrotus droehbachiensis*.

Sea urchins have been studied extensively in developmental biology because of the relative ease of observation of early cell divisions in the transparent embryos. However, the transparency of early sea urchin embryos potentially makes them vulnerable to the effects of ultraviolet radiation; a topic of escalating concern due to the climate crisis and depleting ozone layer. The objective of our study was to determine the effects of direct UV radiation on early embryonic development of Strongylocentrotus droebachiensis through irradiation of eggs (pre-fertilization) and embryos at important and distinctive cell division stages. We hypothesized that sea urchin embryos that were irradiated prior to fertilization and those irradiated post-fertilization would show significant degradation in comparison to those embryos that had not been exposed to UV radiation. We separated sea urchin eggs among 24 glass petri dishes and irradiated treatments at critical developmental stages. The average percentage of embryos at the correct developmental stage 24-hours postfertilization (p=0.0122, F=4.693) and 48-hours post fertilization (p= 2.27x10-7, F=28.081) were significantly different among those treatments from eggs or embryos exposed to UV radiation versus those not exposed to UV radiation. Based on the results of the 24- and 48-hour post fertilization treatments, exposure to UV radiation either slowed development or halted it altogether. These results raise developmental concerns for many shallowwater marine organisms should ultraviolet radiation increase in the near future.

P1.28 TERRY RICHARDSON^{1,2}, JEFF SELBY², AND MIKE HOWELL³. University of North Alabama¹, AST Environmental Group², Samford University³. <u>Habitat</u> Enhancement and Conservation of the Watercress Darter, *Etheostoma nuchale*.

The Watercress darter, Etheostoma nuchale, is a small (approximately 5 cm), bottomdwelling fish federally listed as endangered in 1970. The darter is endemic to limestone springs and associates with dense aquatic vegetation or filamentous algae. Collections at Roebuck Spring were made in February 2009 prior to installation of a permanent water control structure and in September 2009 after installation to compare the potential effects of the water control structure on darter population densities and characteristics. A 2-meter wide x 1.2-meter high seine with a 4-millimeter mesh size was used to collect the darters. Watercress darters averaged e 2/m² in February and were over two times more abundant in the September samples at 5.2/m². Seven of nine spring-pond sampling stations exhibited increased darter densities from February to September. Additionally, darter abundance in the spring-pond appears higher now than since 1988. The population structure was noticeably different between the two sample periods with more juveniles in the September samples compared to February. Historical data and evidence from February sampling prior to construction and September sampling following construction and a spawning season indicate construction of the water control structure may have contributed to successful population growth of the darter. The increase and subsequent maintenance of more submerged habitat created by the water control structure has provided more cover and spawning sites benefiting the darter.

P1.29 RYAN HUISH¹, TEVITA FAKA'OSI², HEIMULI LIKIAFU², MARIKA TUIWAWA³, JOSEVA MATEBOTO⁴, LEX THOMSON⁵, DAMON LITTLE⁶. Hollins University¹, Tongan Ministry of Forests², University of the South Pacific³, Fiji Department of Forestry⁴, Secretariat of the Pacific Community⁵, New York Botanical Garden⁶. The sustainable management and conservation of Santalum yasi (Sandalwood) in Fiji and Tonga: A combined ecological and genetic approach.

Valued internationally for the aromatic oil found within its heartwood, Sandalwood (Santalum, Santalaceae) is one of the most heavily exploited groups of plants across its range. Fijian/Tongan Sandalwood (Santalum yasi) has had a long history of extensive harvesting and is threatened with extinction, yet it has been vastly under-studied. To help develop sustainable management strategies for this culturally and economically valued resource, various ecological and population genetic data was collected and analyzed. Population dynamics, current species distribution, and ecological threats were investigated to find that the few remaining wild stands display discontinuous size class structures, extensive hybridization, regenerative stress, and that the natural distribution has diminished significantly, even to local extinction in some areas. Using a nuclear microsatellite analysis, genetic variability within and between populations was investigated. Results suggest that there is no significant genetic variation between populations, but that most of the genetic variation lies within populations. This genetic distribution suggests that there is a significant level of gene flow between and among populations, most likely through human induced dispersal, showing a more panmictic trend than previously supposed. This may provide molecular evidence confirming the oral histories of extensive interaction between Fiji and Tonga and their trade of plants and culture. Based on the findings of this research, it is suggested that forestry and governmental efforts should focus on the promotion of local involvement in assisted natural regeneration of wild stands and preservation of genetic variation through in situ, community-mediated conservation.

P1.30 BYRON HAMSTEAD, KEVIN WHITE, AND MICHAEL GANGLOFF, Appalachian State University. Effects of Riparian Landuse on Stream Habitats and Macroinvertebrate Communities in the South Fork of the New River, Ashe and Watauga Counties, North Carolina.

Stream habitat degradation is strongly influenced by anthropogenic factors, including landuse at the local and drainage scale. Recently, western North Carolina has experienced dramatic human population growth including a shift in rural land use from forest and agriculture to low-intensity residential development. To understand the consequences of these changes for aquatic communities, we sampled benthic macroinvertebrate assemblages and conducted rapid habitat assessments at 18 sites on the South Fork of the New River (SFNR). We selected study sites that reflect the current mosaic of land use in the SFNR including 3 sites in each of the following riparian landuse classes: forest-forest (FF), forest-agriculture (FA), forest-developed (FD), agricultureagriculture (AA), agriculture-developed (FD), and developed-developed (DD). For each sample we identified all invertebrates to the lowest practical taxonomic level (genus for most EPTs, family for Diptera). ANOVA revealed that DD benthic communities exhibited significantly lower Shannon H' and evenness than other riparian site types. Moreover, FF sites exhibited significantly higher EPA habitat scores yet FF benthic invertebrate metric scores were not significantly different from other site classes. These data suggest that even the low-intensity residential development characteristic of many mountain communities may increase homogeneity of aquatic invertebrate communities. However, the effects of localized riparian disturbances on benthic macroinvertebrate communities appear to be, for now, buffered by nearby forested reaches. Ongoing work will attempt to evaluate how large-scale (e.g., watershed) landuse changes are affecting invertebrates and their habitats in the SFNR drainage and adjacent developing mountain watersheds.

P1.31 EMILY BIDGOOD. University of North Carolina at Chapel Hill. of North Carolina. Conserving "A Million": Using GIS to analyze the past 10 years of conservation in North Carolina.

In 2000, North Carolina's General Assembly passed the Million Acre Initiative (MAI), a legislative commitment to support protection of one million acres across the state by 2010. My research uses geospatial mapping and analysis to take an ex-post look at the natural resources and environments conserved by MAI's "success portfolio", as well as the implied priorities of the past decade of North Carolina conservation. The project has been carried out in conjunction with NC Natural Heritage Program and is intended to help North Carolina conservation stakeholders understand what is currently conserved and how conservation should proceed in the future. The poster will present the results from analyzing the conserved (or missed) water resources of the state; NC Natural Heritage element occurrences and significant areas; and state priorities from NC Department of Environment and Natural Resources' Conservation Planning Tool, a software tool that assigns conservation priority rankings through three assessments: Biodiversity Habitat and Wildlife, Agriculture Threats and Viability, and Water Services. The poster will also address what lands the state should count as permanently protected and how close we are to the goal of a million acres.

P1.32 KATHRYN STEPHENSON CRAVEN. Armstrong Atlantic State University. Nest Failure in Leatherback Sea Turtles (Dermochelys coriacea) on the Georgia Coast.

Leatherback sea turtles are only occasional nesters on the Georgia coast. They average less than three nests per year and have a history of extremely poor hatch success in the state. The goal of this investigation was to determine if nest failure was the result of infertility, embryonic death or other environmental factors making Georgia an unsuitable

incubation environment for the Leatherback, in contrast to the good nest success seen in Loggerhead sea turtles on the same beaches. In 2009, seven nests were deposited on five different barrier islands. Genetic testing confirmed that the nests were deposited by two different females. Hatching success was negligible for Female A (N=2 nests), who had been tagged in Juno Beach, FL prior to nesting in GA; and nonexistent for Female B (N=5 nests), with no known nesting history. Some leatherback nests were relocated and some were left in situ. Unhatched eggs from six nests were obtained and examined for signs of fertility and embryonic development. The diversity of nest locations suggested that nest failure was not island-specific. Invasion of the nests by plant roots was one identifiable problem, however, few other clues were found to explain poor hatch success. In future years, it is highly recommended that the eggs are incubated in a hatchery. This would establish whether the eggs were infertile (a maternal problem) or the environment on Georgia beaches (sand grain and temperature) is truly suboptimal for Leatherback nest incubation.

P1.33 TIFFANY KOSCH AND KYLE SUMMERS. East Carolina University. <u>Distribution of the Amphibian Fungal Disease Chytridiomycosis in Peruvian Amphibians</u>.

Chytridiomycosis is an amphibian disease caused by the chytrid fungus Batrachochytrium dendrobatidis (Bd). This disease-implicated as one of the main causative agents of worldwide amphibian declines and extinctions —is considered to be the worst infectious disease ever recorded among vertebrates. Currently, very little information is available concerning the status of this disease in Peru, a country renowned for both high amphibian diversity and endemism. The aims of our project were to determine the current distribution of chytridiomycosis infections in amphibian populations throughout Peru. Disease sampling was conducted at 33 geographically dispersed sites throughout Peru from June 12 through August 11 of 2007 and February 10 through July 24 of 2008. These sites spanned the north-south axis of the country as well as the highlands and lowlands along the eastern slopes of the Andes, providing a collection of samples along both latitudinal and altitudinal gradients. The results of our PCR-based diagnostic assay showed that 11 of 981 individuals sampled were positive for Bd. Our results show that Bd is widely distributed throughout Peru, with prevalence ranging from 0 to 17%. Bd was detected in species of anurans belonging to 8 families (Aromobatidae, Ceratophrydae, Hemiphractidae, Hylidae, Leiuperidae, Leptodactylidae, and Strabomantidae). This is the first study to report the widespread occurrence of Bd throughout Peru. Our results have potentially grave the implications for the amphibians of this biodiversity hotspot and we strongly recommend that further research should be conducted to determine the conservation status of Bd-infected Peruvian amphibians.

P1.34 E. NATASHA VANDERHOFF¹, ANNE-MARIE HODGE², BRIAN S. ARBOGAST², JOSEPH R. BURGER³ JEFFERY D. CAMPER⁴ AND TRAVIS W. KNOWLES⁴. Jacksonville University¹, University of North Carolina, Wilmington², University of New Mexico³, Francis Marion University⁴. The margay (Leopardus wiedii) as a flagship species for conservation in the foothills of the Andes.

Wildsumaco Wildlife Sanctuary (ca. 500 ha; ~1400 m elevation) is a new preserve located near Sumaco National Park, in the eastern Andean foothills of Ecuador. A camera-trap survey was initiated in December 2008 and the margay (*Leopardus wiedii*), a small neotropical cat about which little is known, has been one of the most frequent captures to date with over 50 captures of at least four individuals. The margays of Wildsumaco are facing increasing threats from encroaching human settlements, including agriculture, hunting, and disease from domestic canines. The margay is a promising flagship species for the area; this small charismatic carnivore plays an important ecological role and can be used to connect locals to larger conservation issues in the region. Our long-term research and conservation program aims to determine population dynamics, ecological

relationships and conservation priorities for margays in the area. These efforts will be meaningless unless members of the local community play an integral role. Partnering with and engaging local community members in margay conservation will strengthen and sustain overall conservation efforts in the region.

P1.35 JONATHAN STORM¹ AND JUSTIN BOYLES². University of South Carolina Upstate¹, University of Pretoria². Effect of White-Nose Syndrome on Body Temperature and Mass Loss of Hibernating Little Brown Bats (*Myotis lucifugus*).

Hibernating bats in the northeastern United States are being decimated by white-nose syndrome (WNS). Although the ultimate cause of death is yet to be determined, it appears related to the premature depletion of fat reserves. Previous research has suggested the root cause of starvation is the namesake white fungus of WNS, Geomyces destructans. During hibernation, the immune system is suppressed; however, it is possible that immune function may be restored by maintaining a higher body temperature (T_b) during hibernation. Although an elevated T_b facilitates an immune response, it also accelerates the depletion of fat stores. We sought to determine if little brown bats (Myotis lucifugus) hibernating in WNS-affected hibernacula have an elevated T_b and reduced fat stores, relative to bats not affected by WNS. We found that WNS-affected little brown bats maintain a significantly higher skin temperature (T_{skin}), relative to surrounding rock temperature, than do WNS-unaffected Indiana bats (M. sodalis) from Indiana. However, this difference in T_{skin} is small and we argue that it is unlikely to explain the premature starvation seen in WNS-affected bats. We also report that WNS-affected little brown bats weigh significantly less than little brown bats not affected by WNS.

P1.36 GERRY PRESLEY AND ANDREW METHVEN. Eastern Illinois University. Production of Edible Mushrooms from Wetcake.

As part of an effort to develop a sustainable fuel source, ethanol produced from fermented corn has been used in many applications including automobile fuel. The fermentation process extracts sugars from corn and converts it into ethanol leaving behind a solid waste known as wetcake which is often used as livestock feed. Considering the negative environmental impacts of the livestock industry, and the fact that there is a surplus of wetcake, alternative methods of wetcake utilization are needed. Since fungi consume dead organic matter as a food source, they are suitable organisms to be tested for decomposition of wetcake. In this study, two edible mushroom species, Pleurotus ostreatus and Hypsizygus ulmarius, will be examined to determine if they can produce not only a nutrient rich fertilizer from the decomposed wetcake but an edible byproduct. During the course of this study, varying moisture levels as well as a multitude of supplements will added to the substrate mixture to improve decomposition. The dry mass of the mushrooms produced will be compared with the dry mass of the initial wetcake to determine biological efficiency. The biological efficiency of the mushrooms will be compared to livestock based on the mass produced per unit of wetcake and the mass of protein per unit of wetcake.

P1.37 SCOTT PEYTON, SUSAN MURRAY. Mississippi Department of Wildlife, Fisheries, and Parks, Mississippi Museum of Natural Science. <u>Current Activities and Available Biological Resources at the Mississippi Museum of Natural Science</u>.

The Mississippi Museum of Natural Science has maintained scientific collections since 1935. Currently, the Museum collections contain over one million specimens in Paleontology, Herpetology, Ichthyology, Ornithology, Mammalogy, Invertebrates, Botany, and Genetic Resources, , representing one of the largest single references for Mississippi fauna, flora, and fossils in existence. Most (but not all) specimens are from Mississippi, but

the collection includes specimens from outside of Mississippi, primarily in the southeastern United States. The museum actively acquires specimens through staff collecting activities, donations from other institutions, deposition of voucher specimens by scientists from other state and federal agencies and universities conducting research in Mississippi, and by donations from the general public. From July 1 2008 to June 30 2009, over 87,000 specimens were added to the collections, most of which were freshwater fishes (approximately 80,000). Most collection records are maintained in computerized databases. Specimens are available for examination by qualified scientists on site or through loans to qualifying institutions. In addition to maintaining collections, museum staff conduct research relating to conservation of animals and plants in Mississippi. Ongoing projects include surveys for the oldfield mouse (Peromyscus polionotus), spotted skunk (Spilogale putorius), mussel surveys in the East Fork Tombigbee River, monitoring numbers of wintering plovers on the Mississippi Coast, surveys for crayfish in the genus Hobbseus, surveys for rare or endangered plants in Mississippi, population assessment of Graptemys oculifera in the Pearl River, and describing the diversity and distribution of ancient echinoids from coastal deposits of Late Cretaceous age in eastern North America.

P1.38 MAE KILE, JOEY SHAW, EMILY BLYVEIS AND JENNIFER BOYD. University of Tennessee at Chattanooga. <u>Scutellaria montana</u> (<u>Lamiaceae</u>) 2009 monitoring at the Volunteer Training Site, Tennessee Army National Guard, Catoosa Co., Georgia.

Scutellaria montana is listed as federally threatened under the Endangered Species Act, and 48 populations of this perennial herbaceous plant have been documented in 11 counties of southeastern Tennessee and northern Georgia. In 2002, a large population of S. montana was found at the 648 hectare Volunteer Training Site (VTS) in Catoosa County, Georgia. VTS, under U.S. Army regulations, must manage for the protection of S. montana, and an annual monitoring protocol was established in 2004 to survey population trends and determine impacting factors as part of this requirement. This protocol set up 46 permanent, nonrandom monitoring plots of 10 m radius to survey the total number of individuals and other health indicators. Previous years of surveying identified the highest number of individuals in the plots at 1,475 in 2005 and the lowest number at 354 in 2008. This decline in the total plants may possibly be contributed to drought conditions experienced in the area from 2007 through 2008. This study in 2009 found a total of 1,282 plants, increasing 262% over 2008 counts. While flowering plants decreased to 12% of total plants in 2009, juveniles comprised 47% of the total. Low fecundity suggests that S. montana is still recovering from the drought, but a high number of juveniles suggests that the population is doing well.

P1.39 JAMIE ADAMS, LINDSAY BROTHERTON, PAUL SMITH, AND THOMAS NELSON. North Georgia College and State University. <u>Movements of southern flying squirrels</u> (*Glaucomys volans*) in a fragmented forest.

Southern flying squirrels are found in forested habitats throughout the eastern U.S., inhabiting deciduous and mixed forests. Because the species moves primarily by leaping and gliding among trees, forest fragmentation may impact movements, home range, and dispersal. Yet, few studies have addressed the spatial ecology of this species. We initiated a long-term study to investigate the: (1) home range size, (2) habitat use, and (3) impacts of road development on the movements of squirrels in a mixed hardwood forest on the North Georgia campus. Squirrels were live-trapped, radio-collared, and tracked weekly from May-October 2009. We live-trapped a total of 13 squirrels; 7 males and 6 females. The mean fixed-kernel home range size for all squirrels was 8.3 ha (4.4 SE), whereas core areas averaged 2.1 ha (1.2 SE). These home ranges are generally comparable to those reported by other researchers in the SE U.S. Of 16 den trees, 81% were either white oaks or poplars. Den trees tended to be living trees with large dbh (mean = 136 cm;

SD = 37.3). During construction of a 30-m wide road, squirrels shifted their activities away from the disturbance. Subsequently, the road proved to be no barrier to movements as individuals were sometimes located on both sides in a single activity period. Research is continuing to better quantify seasonal movements and microhabitat use.

P1.40 TRAVIS PERRY AND MICHAEL JIANG. Furman University. <u>A GIS analysis of habitat selection by puma (*Puma concolor*) in southcentral New Mexico.</u>

Puma (*Puma concolor*) are large charismatic carnivores that present a number of significant conservation problems. Puma occur at low population densities and require large areas to maintain viable populations. It is unlikely that puma utilize the habitats within these large areas randomly. Understanding pumas' habitat preferences is fundamental to the responsible management of puma conservation and management areas. We compared location data collected from six GPS collared puma collected over a period of 24 months to 1,000 random locations over a 300 sq Km area of southcentral New Mexico. A binary logistic regression was used to determine whether puma locations differed predictably from random locations with respect to habitat variables elevation, slope, aspect, vegetation type, and topographic ruggedness extracted from GIS layers. Puma used the available habitat non-randomly with respect to topographic ruggedness and vegetation type.

P1.41 ROBERT ATKINSON¹, HERMAN HUDSON¹, AND JAMES PERRY². Center for Wetland Conservation at Christopher Newport University¹, Virginia Institute of Marine Science². Tree survival and growth in created wetland mitigation sites in Virginia.

Poor survival and slow growth rates of planted woody vegetation in forested wetlands have been a major limitation of created forested wetland performance. There are numerous species of woody plants and planting types available for planting, however, few studies have addressed how planting material (species and planting type) affects the survival and growth of woody species in created wetlands. The purpose of this study is to evaluate the performance of seven species and four planting types. Species including Betula nigra, Liquidambar styraciflua, Platanus occidentalis, Quercus bicolor, Q. palustris, Q. phellos, and Salix nigra were planted as bare root, potted (3.8-L pots), tubeling with soil around the roots, and tubeling without soil around the roots. Three wetland mitigation sites were selected for planting in the northern Piedmont physiographic province of Virginia. Planting occurred on March 9-10, 2009 and survivorship and growth (canopy width, stem width at base, and height) of individual trees was monitored immediately after planting and again in Aug 17-20, 2009. There were 1596 trees planted and 1375 trees survived the first growing season (86.2% survival). Two-way analysis of variance found L. styraciflua tubelings had the lowest overall survival (57.3%) while Q. bicolor potted and S. nigra potted had the highest survival (98.7%). Tubelings without soil had the lowest survival (75.5%) while the potted planting type had the highest survival (92.3%). Dieback was extensive as 579 trees out of 1375 (42.1%) exhibited negative percent change in height. Quercus palustris tubelings had the highest percentage of trees with dieback (85.29%).

P1.42 MICHELE BROWER¹, BRYAN COLVARD², YOSUKI SAKAMACHI¹ AND SHEA TUBERTY¹. Appalachian State University¹, North Carolina Soil and Water Conservation District Office (Wilkes County)². An Exploration of Chicken Litter-Induced Trace Metal Phytotoxicity in Plants.

The overall goal of this study is to assess the adverse impacts of phytotoxic trace metals from long-term chicken litter application to corn and fescue. Confined animal feeding operations are having a potentially huge economic and environmental impact on local communities. The focus of this study will be the phytotoxic effects of these metals (Cu, Zn,

As, Mn). I propose two main hypotheses: H₁: crop plants exposed to supplemented levels (representative of 40-80 years into the future) of metals will exhibit acute and chronic phytotoxic biomarkers of exposure, H₂: with continued application of trace metals to farm soils, productivity will be unsustainable in the near future. I have determined the current concentrations and ratios of trace metals in the soils of fields amended long-term (20-30 years) with chicken litter. These concentrations will be used along with an in-field tissue burden study in 2009 to establish protocol for a greenhouse toxicity study. Both acute and chronic assessment techniques will be utilized. Briefly, these measurements include the following endpoints: percent seedling germination, percent seedling emergence, root/shoot length, biomass and leaf condition. If my hypotheses are borne out, this research will determine the adverse effects of the spreading of chicken litter on agricultural communities. This project will address the inherent complexities of balancing management of sustainable rural economic growth and conservation of important natural resources such as fertile bottomland farming soils for generations to come.

P1.43 JACQUELINE D. ROQUEMORE AND ROBERT B. ATKINSON. Christopher Newport University. <u>Use of a Nontidal Wetland Floristic Database in Wetland Mitigation Assessment.</u>

The presence of specific vegetation types is fundamental to defining an area as a wetland and essential for many wetland functions and values. The species composition of colonizing vegetation provides insights into successional trajectory and is a component of compliance monitoring under state and federal wetland mitigation statutes. The purpose of this study is to use vegetative data collected from wetland mitigation monitoring to develop a database for standardizing, organizing, storing, and aiding in the analysis of wetland herbaceous vegetation data. All plants less than 1 m in height were identified to species in 900 1-m² nested subplots within 300 10-m² plots (3 subplots per plot) at 7 restored wetland mitigation sites in central and southeastern Virginia during the 2007 and 2008 growing seasons. Floristic and site-specific information was compiled using Microsoft Access 2003 ® database software. Juncus tenuis Willd. and Solanum carolinense L. were the most frequently occurring plant species of the 166 species found. Lonicera japonica Thunb. and Duchesnea indica (Andr.) Focke were the most frequently occurring nonnative species and L. japonica was the most frequently occurring and important invasive species. Sites 8-years post restoration had the highest percentage of annual species (19.0%) and sites 4-years post restoration had the lowest (11.7%). Refinements to the database will increase ability to translate the presence of plant species in the herbaceous layer into a quantifiable representation of environmental quality. The use of database technology for the application and analysis of existing vegetative data will ultimately improve future replacement wetland projects.

P1.44 JILL ELLEN BOURDON. Western Carolina University. <u>Location and Simulated Harvest/Disturbance Effects on the Medicinal Herb Chamaelirium luteum L.</u>

Recently, there has been concern about sustainability of wild-harvested medicinal plants. One species, *Chamaelirium luteum*, has experienced an increase in both demand and price. Harvesting individual plants can change population structure, reduce flowering and seed set and potentially reduce population size to under the threshold of viability. Only the *C. luteum* root is used in the herbal market; however, harvesting for the root can damage an entire plant and the plant's unique reproductive biology can make recovery from harvest difficult. My research examined plant location and simulated harvest effects (plant disturbance) on *C. luteum* population structure and reproductive biology. Results of a transplant experiment at Bent Creek Experimental Forest revealed neither plant location (beneath canopy vs. in the open) nor simulated harvest (plant disturbance) affected survival, the proportion of plants that flowered, ratio of male to female flowers, or number

of basal and stem leaves. The long-lived rhizome of *C. luteum* may allow the plant to tolerate disturbance and help sustain populations over environmental variation.

- P1.45 Canceled
- P1.46 JENNA HAMLIN AND JENNIFER RHODE WARD. University of North Carolina Asheville. <u>Population and Genotype-Level Effects on Light Responses in an Invasive Liana</u>.

Celastrus orbiculatus (oriental bittersweet) is a non-native liana whose density has reached invasive proportions in western North Carolina. C. orbiculatus' invasion success is correlated with its ability to survive and change when colonizing different environments. Hence, both phenotypic plasticity and genetic diversity can affect the ability of these plants to survive across diverse habitats. Previous research tested bittersweet seedlings' growth under a range of light conditions and found significant differences among treatments. I used a common garden experiment to test the growth of different bittersweet populations and genotypes under various light environments and found significant differences among both populations and genotypes. One population, Baldwin Gap, outperformed other populations in leaf, stem, and root mass, so its genotypes might be particularly threatening to native plants. In 2008, both seeds and adult plants were collected from these same populations to examine genetic relationships between adult plants and their offspring using AFLP-PCR. Increased genetic diversity in seedlings could indicate outbreeding among populations, while loss of diversity could reflect the effects of natural selection. This work could lead to the identification of populations that are differentially adapted and might identify connections between genotypes and performance.

P1.47 KRISTINA CONNOR. U.S. Forest Service, Southern Research Station. Germination and field survival of *Sarracenia leucophylla* seeds.

Sarracenia leucophylla seeds were harvested and the following tests applied: (1) One hundred seeds were immediately put in a growth chamber set at 30°C with light for 16h and 25°C, no light, for 8 hours to test initial viability; (2) one hundred seeds were cold stratified at 4°C for 60 days and then placed in the growth chamber; (3) another 100 seeds were soaked in 10% bleach for 1 minute, rinsed, divided into 2 lots of 50 seeds each, and each lot sprinkled into a pot filled with a 50-50 mix of coconut husk and sand. Nets were tented over the pots, and the pots were then placed in a tray filled with rainwater; (4) one hundred seeds were placed in each of 56 screen-wire bags which were then buried in tubs of peat moss and sand, kept moist by a rainwater irrigation system. Bags will be harvested at regular intervals and seed viability tested; lastly (5) seeds were placed in storage at 4°C. Every six months, a vial containing 400 seeds will be removed from storage and tested for viability. Seeds placed immediately in the germinator did not put out a root or a shoot, while those cold stratified for 60 days are germinating. Further test results will be reported.

P1.48 SAMANTHA M. IMFELD¹, DERRICK J. HEYDINGER¹, CHLOÉ E. HART¹, MATTHEW H. COLLIER¹, KEVIN M. GRIBBINS¹, JAY A. YODER¹, AND LAWRENCE W. ZETTLER². Wittenberg University¹, Illinois College². Water relations of terrestrial and epiphytic orchid seeds of North America with special reference to species endemic to Hawaii and an only known truly aquatic.

The Orchidaceae is one of the largest and diverse plant families while simultaneously being one of the most limited ecologically as to where they can survive. We explored how orchids are suited for establishment in specific habitats by examining ten species in a water balance study by analyzing seed. Water content, water loss rate, activation energy, critical transition temperature and equilibrium humidity were derived gravimetrically for

Cleistes bifaria, Encyclia tampensis, Epidendrum nocturnum, Habenaria repens, Isotria medeoloides, Liparis elata, L. hawaiensis, Platanthera holochila, P. integrilabia and P. leucophaea. Seeds of epiphytes (E. nocturnum, E. tampensis, L. elata, L. hawaiensis) were smaller in size, lighter, more porous, and retained water less effectively than the terrestrials. Capacity for water vapor absorption and critical transition temperature were absent; i.e., germination requires free water and seeds are protected from rapid drying at high temperature. Results imply that the key viability element for terrestrial seeds is a highly resistant, water-tight seed coat that prevents drying on the surface of the ground, whereas the leaky tendency of epiphytic seeds permits water entry into the seed to infiltrate moisture-rich substrates and remain in the canopy. Characteristics of the aquatic H. repens aligned with the terrestrials, but they rely on low porosity of the seed coat to create an osmotic seal, rather than resist desiccation, to prevent overhydration (drowning) in their freshwater environment. Overall, seed water loss rates varied by species and are presumably linked to maximizing germination in the distinctive habitats these taxa occupy.

P1.49 SHERRIE EMERINE¹, AMANDA WEST², and ROBERT RICHARDSON³. North Carolina State University. <u>Porcelain berry (Ampelopsis brevipedunculata) and bushkiller (Cayratia japonica): two invasive Vitaceae in North Carolina</u>.

Porcelain berry, Ampelopsis brevipedunculata, and bushkiller, Cayratia japonica, are exotic invasive woody perennial climbing vines in Vitaceae. Native to Asia, porcelain berry was likely introduced into the United States in the 1870's for ornamental plantings. It is spread by birds, small mammals, and flowing water. Bushkiller is native to Australia and Asia, and was first discovered in Texas in 1964. It spreads by fast-growing rhizomes and root fragments. Both species exhibit rapid growth rates which allow them to overtop and shade out other species, and climbing habits which damage trees and other vegetation. Research trials were conducted to evaluate plant height and total biomass of porcelain berry and bushkiller under inter- and intraspecific competition. In one study, bushkiller, trumpetcreeper (Campsis radicans), and wild grape (Vitis spp.) were grown alone and with one or both other species per pot. Results indicate that bushkiller grew faster and obtained greater biomass than both other species. A second study with porcelain berry, bushkiller, and Virginia creeper (Parthenocissus quinquefolia) is currently in progress. Greenhouse and field studies of selected herbicides were performed to develop porcelain berry and bushkiller control recommendations. Results indicate that DPX-KJM44, imazapyr, and sulfometuron plus metsulfuron provided the greatest control of bushkiller in the field. Similar trials on porcelain berry are currently in progress.

P1.50 JULIE CLIFFORD AND JENNIFER RHODE WARD. University of North Carolina at Asheville. <u>Variation in Distyly among Individuals and Populations in the Piriqueta cistoides caroliniana Complex</u>.

Plant can evolve morphological mechanisms to ensure gametophytic self incompatibility or otherwise avoid inbreeding. Herkogamy, the spatial separation of stigmas and anthers, is one strategy to minimize self-fertilization. This study focused on distylous (short or long style) individuals from the *Piriqueta cistoides caroliniana* (Turneraceae) hybrid complex, which includes a northern morphotype (*caroliniana*), a southern morphotype (*viridis*), and their late-generation hybrids. Field and greenhouse-grown plants were measured to determine if anther/stigma distance varied among individuals or populations. Results showed that distances varied by morph (short or long style) among the 3 morphotypes and differed over time. Also, the anther/stigma separation was reduced in hybrid populations grown under greenhouse conditions. Occurrences of homostyly or diminishing spatial separation need further study to determine if lack of this morphological mechanism is correlated with the loss of protein incompatibilities that impede pollen tube growth after intramorph crosses. Studies of distylous systems such as the *P. c. caroliniana* complex give us insight plants' evolution, maintenance, and loss of inbreeding avoidance.

P1.51 MIJITABA HAMISSOU. Jacksonville State University. <u>Selected Physiological and Morphological Responses of Arabidopsis thaliana and Sorghum bicolor</u> (L.) <u>Moench to Elevated Salt Concentrations in the Growing Medium.</u>

Increasing demands for food quality and quantity are two major causes for over irrigation and over fertilization of agricultural lands. These two factors combined are contributing to increase in soil salinity which is an impediment to plant growth and development. Plants cannot extract water from the soil unless the water potential in the root is less than the water potential in the surrounding soil. Plants growing in saline environments must also cope with the potential toxic effects of Na⁺ ions. Some plant species are known to cope with soil salinity by synthesizing small molecular weight proteins such as Osmotin, a 26 KD alkaline protein or by accumulating osmolytes such as glycine betaine. Despite large amount of published data in salt stress, there still is no single salt tolerance biomarker used in salt stress research. The objective of this study is to investigate some molecular and physiological responses of Arabidopsis thaliana and Sorghum bicolor plants to high NaCl concentration. Young plantlets were reared and maintained in potted soils in a growth chamber for several weeks and then watered with NaCl solutions for two weeks. Preliminary data indicated that salinity repressed root elongation and caused a reduction in plant relative water content, the chlorophyll content and a reduction in the plants ability to perform photosynthesis. Our data indicated also a possible alteration of several anatomical features and protein synthesis by plants subjected to prolonged salt treatment.

P1.52 DAVID PONDER AND SAFAA ALHAMDANI. Jacksonville State University. Comparison of Antioxidant Concentrations between Kudzu and Selected Common FoodSources.

Kudzu ($Pueraria\ lobata$) is a fast growing plant with ability to withstand wide range of environmental adversities. Kudzu well adapted to southern region of United States and has been recognized as medicinal plant for the last two thousand years. Antioxidant concentration in Kudzu was compared to common food sources including shiitake mushrooms ($Lentinula\ edodes$), spinach ($Spinacia\ oleracea$), and nori seaweed ($Porphyra\ yezoensis$). The results were shown that kudzu had significantly higher concentrations of total phenolics, flavonoids, anthocyanins, and β -carotene followed in decreasing order by Spinach, Seaweed, and Shiitake mushroom.

P1.53 YING CHEN¹ AND MARJORIE M. HOLLAND². University of Mississippi. <u>The Effects on Soil and Native Coastal Vegetation of Storm Surges and Waves: A Preliminary Investigation</u>.

Surges and waves generated by hurricanes and other severe storms can cause devastating damage of property and loss of life in coastal areas. Vegetation in wetlands, coastal fringes and stream floodplains can reduce storm surges and waves while providing ecological benefits and complementing traditional coastal defense approaches such as permanent levees, seawalls and gates. However, recent studies have called into question the role of salt marsh plants in reducing wave-induced erosion at the wetland edge. Our initial hypothesis is that wave attenuation by native vegetation may reduce soil erosion at the marsh edge, but that scouring may occur further inland during storm surges and breaking waves. To test our hypothesis, sediments were collected in December 2009 directly along a coastal edge as well as further inland. Initial samples were obtained at the Grand Bay National Estuarine Research Reserve along two transects: one is in the South Rigolets Island West and the other is in the South Rigolets Island East. The dominant vegetation along both transects is *Spartina alterniflora*. Additional samples were collected at Graveline Bayou in Gautier, MS. There we established another two transects, the vegetation in wetlands, adjacent to the Old Shell Landing Road. On the latter two transects, the vegetation

is primarily *Juncus roemerianus*, with some *Spartina alterniflora*. Laboratory analyses of the soil samples to date include measurements of soil moisture and of soil percent organic matter by the loss on ignition (LOI) method. Initial results suggest LOI of inland sites is lower than that of marsh edge sites on the first two transects, but it is higher than that of marsh edge sites in another two transects. The different plant species on the different transects may account for the variation of organic matter in the sediments.

P1.54 ANDREW S. METHVEN¹ AND ANDREW N. MILLER². Eastern Illinois University¹, Illinois Natural History Survey². Evolutionary relationships of the mushroom genus *Clavariadelphus*: one genus or two?

The genus Clavariadelphus includes a group of club-shaped mushrooms most commonly collected in late summer and fall in northern, boreal, coniferous forests throughout North America. A monograph of Clavariadelphus in North America divided the genus into two groups. The first group included species that function ecologically as litter decomposers with narrowly elongated spores and copious amounts of hyphae binding the substrate to the base of the mushrooms, while the second group included species which form mycorrhizae with broadly ellipsoid spores and little or no hyphae at the base of the mushrooms. While some mycologists have argued that these two groups are distinct enough to be recognized as separate genera, questions about the range of variation in morphological characters, chemical spot tests, and cultural characters have precluded recognition of the two groups as separate genera. The working hypothesis for this project is that the genus Clavariadelphus is polyphyletic and, in order to adhere to a natural system of classification, needs to be subdivided into two distinct genera representing the putative two monophyletic groups. With the refinement of molecular techniques in the last twenty years, a new suite of characters have become available that will allow this question to be resolved. Two nuclear ribosomal genes, the 28S large subunit (LSU) and the internal transcribed spacer (ITS) will be amplified, sequenced and analyzed in an evolutionary context to determine if the genus Clavariadelphus should be segregated into two distinct genera.

P1.55 ALEXANDER KRINGS¹, JOSEPH C. NEAL¹, CAROLINE S. BERNARD¹, AND JEFFREY F. DERR². North Carolina State University¹, Virginia Tech². Weeds of Container Nurseries in the United States.

Cost-effective weed management begins with the correct identification of the weeds present. To aid growers and extension personnel in the development of management programs, there are a number of weed identification resources available online. However, few employ state-of-the-art multi-access keys and fewer still are comprehensive in their coverage. Lacking altogether are digital diagnostic resources that are easily deployable in the field using personal digital assistants (PDAs) or smart phones. This is unfortunate given the costs associated with delayed weed identification and that the technology for field deployable digital products is readily available. Precision agriculture will require mobile access to diagnostic and management decision-aid programs. To help meet this need, we developed two weed identification tools that comprehensively treat the weeds of container nurseries in the US—one accessible online (Lucid), the other deployable in the field on a PDA (SLIKS). Both keys are heavily visual: (1) images obviate reference to a glossary for unfamiliar morphological terms, and (2) images accompany all listed taxa, so users can quickly scan for potential matches while selecting characters. Each taxon is linked to a fact sheet which includes additional images, a morphological description, and performance ratings against thirteen herbicides.

P1.56 MARCELA MORA AND JOHN L. CLARK. University of Alabama. Phylogenetic Examination of the Neotropical Genus Paradrymonia (Gesneriaceae) based on Nuclear and Chloroplast DNA Sequences.

Paradrymonia (Gesneriaceae) is a genus of facultative epiphytic herbs with 38 currently recognized species. It occurs throughout the neotropics except SE Brazil and the Caribbean with centers of diversity in Colombia and Ecuador. Species relationships within this genus were assessed using molecular data generated from the nuclear ribosomal (nrDNA) internal transcribed spacer region (ITS) and the chloroplast trnH-psbA intergenic spacer region. Analyses utilizing parsimony, maximum likelihood and Bayesian inference methods were used to assess phylogenetic relationships among 18 species of Paradrymonia and several other species from other genera within the tribe Episcieae. A preliminary analysis strongly support that Paradrymonia, as currently circumscribed, is polyphyletic and includes taxa in two different clades. A strongly supported clade containing the type species of Paradrymonia includes Chrysothemis pulchella and five species of Nautilocalyx. Another clade including Paradrymonia longifolia and P. anisophylla nest within a paraphyletic Drymonia. Important morphological features such as bearded anthers, rosette habit, and corolla tube angulation are proposed as key morphological synapomorphies.

P1.57 ELOISE CARTER, STEVE BAKER, THEODOSIA WADE, AND ANYIE LI. Oxford College of Emory University. The Live Oak Initiative: Extending Teacher-Scientist Partnerships Regionally and Virtually.

Science education is a national concern recognized by the NRC, AAAS, ESA, and ASB. Scientists share in the responsibility of developing teacher education programs for experienced teachers to enhance their skills. Research has documented the effectiveness of environmental based programs that provide inquiry-based, inter-disciplinary, and collaborative learning. Over 250 teachers have attended the Oxford Institute for Environmental Education participating in inquiry-based science in the field and schoolyard. With support by Arthur Vining Davis Foundations in 2007 the Live Oak Initiative began with three objectives: sustaining the creative work of the OIEE program; invigorating and extending the reach of the program; and empowering teachers as leaders. We developed a website with program information, on-line applications, current events and resources, and publication of teacher-created Schoolyard Investigation Plans. These investigations, categorized by curriculum topic and grade level, provide creative approaches to teaching science, and materials and resources to support the investigations. The Live Oak Initiative targeted high school teachers (most difficult to recruit) and underserved areas in southern Georgia and northern Florida. The website enhanced recruitment by linking to regional professional development sites and environmental organizations. In addition the initiative provided travel funds, classroom grants and stipends for teachers in the targeted regions. The Live Oak Initiative culminates in 2010 with a symposium featuring a plenary speaker and investigative workshops led by program alumni, thus providing opportunities for teachers to be recognized as leaders in environmental education. Challenges and successes will be described, along with examples of teacher investigations and program details.

P1.58 CHRISTOPHER J. PARADISE, LAURIE J. HEYER AND A. MALCOLM CAMPBELL. Davidson College. Integrated systems biology.

First-year courses for biology majors are overflowing with detailed information about too many examples in an attempt to cover every teacher's favorite topic. Books are bloated with factoids, encouraging students to cram for exams rather than learn how to do science. Critical thinking and data interpretation skills are often crowded out by the march through the material. There must be a better way! BIO2010 and many other publications have taught us two important lessons about how people learn best: 1) they should construct their own knowledge and 2) new content must be connected to what students already know. We are writing an introductory biology textbook based on how people learn

best, one that intentionally applies these two lessons, with the goal of helping students discover how to do science rather than just memorize facts. *Integrated Systems Biology* focuses on five "big ideas" of biology, each one at five levels of organization. The text guides students through the process of discovery through interpretation of real figures and data in a problem-based approach. Mathematics is integrated whenever it helps explain or predict experimental outcomes. Ethical, legal and social implications (ELSI) boxes explore human factors and ethical dilemmas that will pervade the most important questions of the 21st century. In this poster, we outline examples of each of these features.

P1.59 SARAH NEY, KELLI M. SLUNT, AND ABBIE M. TOMBA. University of Mary Washington. <u>Analysis of Alarm Chemicals in the Freshwater Crayfish Orconectes rusticus</u>.

Utilization of chemical cues is an important survival tool for numerous organisms, especially aquatic species. This is especially true of crayfish, a common model organism for studying chemical cues. Crayfish have been shown to respond to odors from predator species, injured conspecifics, and food sources by changing posture or rate of movement. Many factors influence the ability of crayfish to detect these cues, such as the distribution and type of odor sources present as well as the local environment. In general, crayfish respond to odor from an injured conspecific (alarm cue) by displaying defensive postures, decreasing locomotion and feeding activity, and increasing shelter use. Studies using Orconectes virilis suggest that the hemolymph, or a substance found therein, produces this behavioral response, and that hemolymph fractions of small mass (5 kDa) produced the most alarm response. It has been hypothesized that a protein involved in clotting may produce the behavioral response, but little is known about the relationship of crayfish behavior and hemolymph chemistry. The present study seeks to confirm that low molecular weight fractions produce the most pronounced alarm response, using a congeneric species Orconectes rusticus. In addition, we attempt to identify the chemical(s) responsible for eliciting these behaviors. Hemolymph samples were fractioned by mass using centrifugal filtration units, and will be further characterized using gel electrophoresis and other techniques. Fractions will be studied for behavioral response using food odor as a positive control. Preliminary results indicate O. rusticus displays an alarm response to both filtered and unfiltered hemolymph samples.

P1.60 MATTHEW ABBOTT, BRANDON FULTZ, JON WILSON, JODY NICHOLSON, ADAM THOMAS, AMANDA KOT, MALLORY BURROWS, BENTON SCHAFER, AND DAVID BENSON. Marian University. Beaver-dredged canal function and development.

The North American beaver (*Castor canadensis* Kuhl) are typically thought of as central place foragers who collect woody plants and building materials and return to a main pond containing a lodge or food cache. It has been suggested that beaver dredge water filled canals to extend access to foraging areas. Using GPS we mapped beaver ponds, canals, and cut stumps for several colonies of beaver in Indianapolis, IN. We also examined changes in beaver canals networks over time. We found that the number of beaver-cut stumps was negatively related to distance from canals, but not from the main body of water. We recommend that studies of optimal foraging take canals into account, where applicable, when attempting to relate foraging to distance from the "central place."

P1.61 LAINY DAY¹, STEVEN WILKENING¹, JED BRENSINGER¹, BARNEY SCHLINGER². University of Mississippi¹, University of California Los Angeles². Estradiol plays a role in activating the courtship display of Golden-Collared Manakins (Manacus vitellinus).

To attract females, male manakins perform acrobatic displays punctuated by loud "wing snaps" and "roll snaps", and by quieter "snips". In tropical species like manakins, hormonal control of display is not well understood. Previously, we found that testosterone (T) activates display behavior of males and induces females to perform male-like displays and that the anti-androgen, Flutamide, alters the display. In addition, we have found that two metabolites of T, estradiol (E2) and the androgen DHT, when combined activate displays more potently than either alone. Order of implantation was important as birds given first DHT and then E2 display less than birds given E2 and then DHT. In this study, to better understand how E2 might play a role in display, we examined the effects of preventing the conversion of T into E2 by administering Fadrozole to block the estrogen synthetic enzyme aromatase. We observed the behavior of captive male and female manakins given silastic implants containing T and fed 20ul of 10 mg/ml Fadrozole daily with those given T and fed saline daily for 30 days. Videos were used to score display elements/min for 60 mins of recording daily. We found that, in T treated birds, blocking E2 synthesis reduced the number of roll snaps in males and the number of snips in males and females with wing snaps being non-significantly reduced in males and females. These results suggest conversion of T to E2 contributes to the activation of display elements in manakins.

P1.62 SCOTTIE JACKSON AND ELIZABETH G. DOBBINS, Samford University. Effects of Limestone Quarry Runoff on Stream Ecology and Prevalence of Invasive clam Corbicula fluminea.

Mining and quarrying activities have a negative impact on stream ecosystems. Quarrying disturbs stream ecology by altering pH and sediment load (Wood & Armitage, 1999). Mining of dolomitic limestone was predicted to have a negative effect on Five Mile Creek. The stream was examined for sediment load, pH, and macroinvertebrate diversity upstream, downstream, and within the outflow creek from Dolcito Quarry, Tarrant, AL. Sediment load was collected using a Helley-Smith bed-load ampler. Quarry sediment significantly impacted the creek: pH was significantly more basic downstream from runoff than upstream (t= 6.3327, P < 0.01) and bed-load sediment was also significantly greater downstream from quarry runoff (t=5.8, P<0.01). Macroinvertebrates were evaluated by diversity, Family Biotic Index (FBI) and percent Ephemeroptera, Plecoptera, Trichoptera (EPT). Macroinvertebrate collections revealed deteriorating conditions moving in the downstream direction. Diversity and decreased within and downstream from the runoff. upstream, and nonexistant in the runoff and downstream. were low Macroinvertebrate samples within the runoff were dominated by Tubifex tubifex and Corbicula fluminea, which comprised 75% of the samples. In contrast, T. tubifex and C. fluminea are less than 10% of all FMC samples. The tolerance value for T. tubifex is 8.4, while the published tolerance value for C. fluminea is 6.1 (ADEM manual). Our work indicates that there needs to be a recalibration of the tolerance value for the invasic clam C. fluminea.

P1.63 WHITNEY RUPPEL, JOHN J. HUTCHENS, JR., AND VLADISLAV GULIS. Coastal Carolina University. Relationship between macroinvertebrate assemblage structure and ecosystem function in two Coastal Plain blackwater streams.

Ecosystem structure is often used to indicate ecosystem function in studies of stream integrity because structure is usually easier to measure. Whether structure can be substituted for function, however, is seldom assessed. We tested whether structural measures (i.e., % of total benthic macroinvertebrates classified functionally as shredders and fungal biomass on leaves) could be used to predict ecosystem function (i.e., leaf decomposition rate). Structural and functional parameters were measured at four sites in each of two forested blackwater streams near Myrtle Beach, SC. Pre-weighed red maple

(*Acer rubrum*) leaves in coarse-mesh bags were sampled monthly from December 2008 to April 2009. Macroinvertebrates colonizing litter bags and fungal biomass (from ergosterol) associated with leaves were quantified. Benthic macroinvertebrates were sampled once using protocols developed for calculating the Coastal Plain Macroinvertebrate Index and additional leaves were sampled for fungal biomass in each site in March 2009. Despite most sites being acidic (pH ranged from 4.12 to 7.96), and having low dissolved oxygen concentrations (range: 0.82 to 6.03 mg/L), we detected considerable microbial activity. Leaf decomposition rates varied significantly among sites, with k values ranging from 0.004 to 0.017 d⁻¹. This range of rates of decomposition rates will be evaluated with respect to fungal biomass and benthic macroinvertebrate functional structure.

P1.64 JOHN KRONENBERGER, THOMAS BALDVINS, MARTIN CIPOLLINI, AND ANDY MONTGOMERY. Berry College. Early effects of restoration practices within a historically fire-suppressed mountain longleaf pine ecosystem on vegetative structure and the bird community.

Logging, land conversion, and fire suppression has decreased longleaf pine (Pinus palustris) ecosystems to only a fraction of their original range. Fire suppression, in particular, has led to overcrowding by hardwoods and litter buildup, leading to indirect effects on the native plant and animal community. In 2001, efforts were initiated to reestablish Berry College's (Floyd County, Georgia) fire-suppressed mountain longleaf pine forest. Various management techniques have been implemented, including prescribed burning, clear-cutting, planting, and herbicide applications, in an effort to restore parts of this forest to its historically open state. This study was designed to determine the effects of these management practices thus far on vegetation structure and on the native bird community. In 2009, we collected data on vegetation structure in five (4 ha) stands in each of three management classes ranging from low to high intensity management: 1) fire suppressed, 2) hack-and-squirt herbicided/burned, and 3) clear-cut/foliar herbicided/hackand-squirt herbicided/burned/planted. Based upon multiple analysis of variance, significant differences were found among the management classes for all vegetative variables except tall shrubs. There were more herbs, grasses, and small shrubs, and lower tree cover, litter cover, litter dry mass, and litter moisture level as management intensity increased. Bird censuses were taken six times in each study stand in summer 2009 and again in winter 2009. Bird species contributions to differences among management classes were evaluated using non-metric multidimensional scaling, and subsequently related to vegetative differences among the management classes. Keywords: longleaf pine, fire suppression, management, vegetation structure, birds

P1.65 VANESSA SANDOVAL ¹, PAULA JACKSON¹, JOSE LUIS ANDRADE², AND THOMAS MCELROY¹. Kennesaw State University¹, Centro De Investigacion Cientifica De Yucatan². A preliminary survey of differences in mushrooming fungi between Dzibilchaltun and Kiuic, Yucatan, Mexico.

Dry tropical deciduous forests found in the Yucatan Peninsula are some of the most threatened ecosystems in the world, yet very little is known about these systems. Additionally, the mycology of the peninsula of Yucatán is, as of yet, largely unexplored and undocumented as are many other areas of México. This study was a preliminary investigation to describe fungal communities associated with two different forest stands (Dzibilchaltun and Kiuic; 8 plots within each site). We surveyed eight 10M X 10M plots at each location in order to document mushrooming fungal communities in each of the field sites. Mushrooms were collected, photographed and classified based on morphology. When possible, a portion of each sample was stored for genetic analysis. We collected more than 50 unique species from each location. We rarely encountered the same mushroom twice during our surveys. There was a small degree of species overlap between the two forest regions (7%). Thus each forest type contained a distinctive

mushroom community. We are currently sequencing the ITS regions of the nuclear genome from the mushroom samples we collected during our survey. Differences in mushrooming community composition associated with different aged forests within the Kiuic forest site will also be discussed.

P1.66 WILLIAM DONALDSON AND RON DAVIS. Western Carolina University. The Effects of Roads and Traffic Intensity on Movement Patterns of the Eastern Box Turtle (*Terrapene carolina* carolina) in Western North Carolina.

Eastern Box Turtle populations are declining over much of their range as habitat is reduced by human land use. Roads act as potential barriers to movements, and can increase mortality and potentially reduce demographic and genetic variation by isolating turtle populations. Radio telemetry data was used to examine movement patterns of eleven individuals in a residential development, Balsam Mountain Preserve, Jackson County, NC. Traffic counters were used to measure daily traffic at turtle crossing locations. Correlation analysis showed a negative relationship (r= -0.37) between crossings and estimated daily traffic count, indicating avoidance of traffic. Telemetry data shows that turtles were captured up to 170 meters away from roads yet, approximately 20% of all captures locations (n = 208) were within 10 meters and 50% fell within 40 meters of roads. Individuals avoided crossing roads with high amounts of traffic and appear to be less effected by secondary road traffic patterns. While traffic intensity appears to influence turtle movements, they apparently are unaffected by the presence of roads which may reflect preference for use of edge habitat created by roads.

P1.67 AMANDA ECKER, C. SMOOT MAJOR and KELLY MAJOR. University of South Alabama. Influences of historical land use and environmental variation on plant community structure and biological invasion in Weeks Bay, AL.

The relationship between prior land use practices and invasive plant species, while considered an issue of immediate concern for sensitive plant communities, is poorly understood and understudied. We are investigating how land use history and environmental variation influence community structure and invasive plant success in the Swift Tract area (~2.5-km²) of the Weeks Bay National Estuarine Research Reserve, AL. Weeks Bay is an ecologically sensitive and economically important resource for the Gulf Coast region, and as such provides an excellent case study for the impact of invasive species on linked terrestrial and aquatic systems. To assess the interplay between land use, environmental variability, and community "invasibility", we are taking a multi-scaled approach. Initial surveys, aerial and satellite imagery, wetland maps, and expert knowledge of the Weeks Bay system are being used to appropriately stratify randomized plots. Plant community structure will be determined through coarse- and fine-scale vegetation sampling across habitat types, taking historical land use into account. Environmental variability will be evaluated by monitoring physical (e.g., irradiance levels, soil type, and temperature) and chemical (e.g., soil and water organic and inorganic nutrient levels, pH, and salinity) characteristics within and among sampling plots. Collected data will be used together with spatial imagery to develop a land classification scheme that can be used as a predictive management tool to identify shifts in plant community composition and structure as a function of short- and long-term environmental change in Weeks Bay, and similar natural areas of concern along the Gulf Coast.

P1.68 NICOLE PARRISH AND BEVERLY COLLINS. Western Carolina University. Habitat connectivity analysis of a disjunct population of the Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*) utilizing vegetation surveys, GIS-based landscape analysis, and denaturing gradient gel electrophoresis techniques.

A disjunct population of the federally-endangered Carolina northern flying squirrel, Glaucomys sabrinus coloratus (Sciuridae), occurs within hemlock-northern hardwoods forests along the Cherohala Skyway in western North Carolina. We combined vegetation surveys, GIS-based landscape analysis, and denaturing gradient gel electrophoresis (DGGE) techniques to identify the squirrel's habitat and examine its connectivity. Vegetation surveys revealed the habitat varies from northern hardwoods to hemlock. Two sites, Big Junction and Hooper Bald, do not differ in tree composition but differ in understory composition. A third site, Whigg Branch, is differs in both tree and understory composition. A GIS model revealed locations of known nest sites differ minimally from random locations. DGGE was performed on scat collected from squirrels caught in traps and nest boxes. Utilizing the Basic Local Alignment Search Tool (BLAST), nucleotide sequences from the scat were compared to sequence databases. Results showed 100 percent similarity between scat samples and Trametes, Ganoderma, and Dothideomycete fungi. Collective results from these analyses indicate Carolina northern flying squirrels forage on common fungi and utilize habitat patches that are similar to surrounding areas along the Cherohala Parkway.

P1.69 SARAH E. STUEBER, JASON W. BOSLEY, CHLOÉ E. HART, MATTHEW H. COLLIER, KEVIN M. GRIBBINS AND JAY A. YODER. Wittenberg University. Differences in habitat preference and suitability based on water balance profiles of *Uca minax*, *U. pugilator*, and *U. pugnax*.

We investigated the potential of three species of co-occurring North Carolina fiddler crabs, Uca minax, U. pugilator, and U. pugnax, to inhabit different ecological niches based on their ability to maintain water balance. Characteristics that these crab species (male adults) share are a 67% body water content, twice the amount of body water as their dry mass, and absence of a critical transition temperature (CTT) that prevents an abrupt, lethal level of dehydration as temperature rises. However, reduced activation energy for water loss in *U. minax* was seen when compared to *U. pugilator* and *U. pugnax*, implying a cuticular modification for enhancing water conservation that is exclusive to this species. This phenomenon is not attributed to epicuticular lipids like in insects, because crabs are not known to have cuticular lipids (hence, lack of CTT). Enhanced water retention capability of *U. minax* is strengthened by large body size (low surface area to volume), as demonstrated by a suppression in Arrhenius frequency factor A (integrated measure of cuticular effectiveness) and a pronounced decrease in net transpiration rate. Higher activation energies coinciding with high net transpiration rates for smaller U. pugilator and U. pugnax suggests that they are more porous to water flux. The distinctive ability of U. minax to retain water allows them to occupy terrestrial inland habitats and to thrive in freshwater by being less porous to water entry. U. pugilator and U. pugnax lack these water retention features and are therefore restricted to more moisture-rich habitats.

P1.70 JON DAVENPORT AND DAVID CHALCRAFT. East Carolina University.

<u>Different kinds of habitat complexity alter predator-prey interactions in different ways.</u>

Habitat complexity has often been viewed as an important factor that can reduce the impact of predators on prey by providing refugia for prey. Sit-and-wait predators, however, may perform better in complex environments that provide more perches or hiding places for the predator. We conducted an experiment in artificial ponds to examine how different kinds of habitat complexity (amount of leaf litter versus amount of emergent vegetation) influence the effect of a sit-and-wait predator (larval dragonflies; *Anax* spp.) on fitness components of larval salamanders (*Ambystoma opacum*). We expected increasing amounts of emergent vegetation to enhance the effect of *Anax* on *A. opacum* fitness while increasing amounts of litter would reduce the effect of *Anax* on *A. opacum* fitness. Leaf litter and emergent vegetation amount had no effect on *A. opacum* survivorship in ponds

with no *Anax. Anax* reduced *A. opacum* survivorship but the extent of reduction depended on the amount and kind of habitat complexity present. Specifically, increasing amounts of emergent vegetation in ponds with low amounts of litter enhanced the negative effect of *Anax* on *A. opacum* survival. The amount of litter present did not alter the effect of *Anax* on *A. opacum* survival except when there was a low amount of emergent vegetation present – in this case it reduced the effect of *Anax* on *A. opacum* survival. Our results demonstrate that different kinds of habitat complexity can alter predator-prey interactions in different ways – in some ways it benefits the predator while in others it benefits prey.

P1.71 BEN DELANCEY¹, TRAVIS PERRY², THERESA THOM³, AND DAVID SHELLEY⁴. Furman University¹, Congaree National Park². <u>Assessment of Sus scrofa disturbance on herpetofauna in Congaree National Park, South Carolina</u>.

Feral pigs (Sus scrofa) are a primary agent of disturbance in the ecosystems where they occur, often to the detriment of surface soils, native flora, and native fauna. Feral pigs are increasingly abundant within Congaree National Park (CNP), resulting in the need for data regarding feral pig impacts to park resources. In order to assess the impacts of Sus scrofa on herpetofauna populations within Congaree National Park, two research sites were utilized, each of which contained two treatments of hog disturbance classified as either "high" and "low" hog disturbance. Hog disturbance was determined using field observations, remote cameras, and previously collected telemetry data. Herpetofauna populations were monitored with timed visual encounter surveys and artificial coverboard surveys during a seven-week period in June and July, 2009. The total number of species detected (using visual encounter surveys and coverboard surveys) was identical for both disturbance treatments. Coverboard surveys also showed an equal number of total individuals encountered in high hog disturbance and low hog disturbance areas, although species evenness was greater on the high hog disturbance areas than the low hog disturbance areas for both sites. Variables other than hog activity (such as the availability of stable substrate in an active floodplain) are believed to have equal or greater force in shaping the structure of herpetofauna populations within Congaree National Park.

P1.72 EMILY PRICE AND RAY WILLIAMS. Appalachian State University. <u>Effects of simulated climate change on the abundance of an exotic weevil, Cyrtepistomus castaneus.</u>

Alteration in climate due to human activity may change the relationships between host plants and non-native insects. The Throughfall Displacement Experiment (TDE) at Oak Ridge National Laboratory investigated the effects of precipitation alteration within an intact hardwood forest. The experimental design consisted of three treatments, 33% reduction or addition of collected precipitation using canopy troughs, and non-manipulated plots. The site also consisted of an upper and lower slope, providing the possibility of landscape level effects. We quantified the abundance of the Asiatic Oak Weevil, Cyrtepistomus castaneus collected in pitfall traps at the TDE. This beetle attacks a variety of hardwood tree species, with a special preference for trees in the genus Quercus and Acer. We used prevalence of preferred tree species and data on physical parameters of the forest floor to compare with weevil abundance data. There was a significant (P<0.05) affect of treatment and slope position on C. castaneus abundance. The weevil was generally more numerous upslope and most abundant in the wet plots. Forest floor physical parameters did not relate to the number of weevils collected, rather host plant prevalence seemed to be a more robust determinant of their distribution and number. More preferred tree host existed upslope and in wet plots compare to either the ambient or dry plots. Our data does suggest, however, that other factors aside from host plant prevalence possibly contributed to our observations.

P1.73 CHLOÉ E. HART, MATTHEW H. COLLIER AND JAY A. YODER. Wittenberg University. Release of neryl formate prevents detection of red velvet mites by ants when feeding on aphid/scale prey in honeydew-laden habitats.

This is the first report of a tritrophic interaction among ants, red velvet mites (Balaustium sp. nr. putmani), and diaspid scales and aphids. We hypothesized that honeydew, excretory product of scale and aphids: (1) acts as a signal (kairomone, host cue) to mites aiding in the identification of scale and aphid prey; (2) retains mites on leaves where scale and aphids are present, signaling prey quality and quantity; and (3) serves as an alternate food source for mites. Short range, two choice attraction bioassays, modified from mite semiochemical work, were used in the experiment. In response to raw honeydew, mite movement stopped, 80% of mites were retained on honeydew-coated surfaces, and a clustering response was observed. Blue coloration appears in mites if honeydew is stained with Evans blue indicating that it is consumed. Lack of crawling or redirection of movement toward the honeydew imply that it does not contain a mite attractant; i.e., the response is tactile-related. Glucose, sucrose, fructose and trehalose (0.001M - 0.1M), components of honeydew, are not active arrestment ingredients based on inconsistent mite responses. Further experiments involving treated prey reveal that mites are not attacked by ants in habitats where honeydew is found because mites have a cryptic alarm pheromone (neryl formate, bears structural congruency to ant pheromones) that makes them 'invisible' to the ants. By secreting this pheromone, mites are not detected by ants and are therefore able to prey upon aphids and scale found in these habitats unharmed.

P1.74 ALEXANDRA E. SACK, ANNA E. BIANCHI, AND PETER A. VAN ZANDT. Birmingham-Southern College. Males Altogether and Females Alone: Relative Costs and Benefits of Shelter-Sharing in Tropical Caterpillars (Desmia sp.) Depend on Sex.

Shelter building occurs when caterpillars modify a leaf to form rolls, ties, or sandwiches. These shelters apparently protect caterpillars from predation and provide favorable microclimates during feeding. We studied caterpillars of Desmia sp. (Lepidoptera: Pyralidae) feeding on Notopleura capitata (Rubiaceae) in a lowland tropical rainforest in Costa Rica. These caterpillars often share shelters with as many as eight conspecifics. Previously, we showed that caterpillars do not suffer more parasitoid attacks when feeding in larger groups compared to those feeding alone, which led us to evaluate other costs and benefits for shelter sharing. In this study, we asked whether the costs of shelter sharing (due to greater intraspecific competition) were outweighed by the benefits (distributing shelter building among multiple individuals). To examine the relative impact of these two factors, we conducted a full-factorial shade house experiment varying both caterpillar density (1 or 3 caterpillars per shelter) and disturbance, (rebuilding the shelter every 1 or 4 days). Overall, caterpillars forced to rebuild shelters daily had a lower pupal mass than caterpillars disturbed every 4 days. However, males were heaviest when sharing shelters, while females were heaviest when feeding alone. In terms of development time, each sex responded differently to disturbance: males developed faster and females developed slower when disturbed daily. Females had lower survival across all treatments, but this difference was greatest when caterpillars were alone and disturbed daily. In total, male Desmia sp. caterpillars appear to benefit from sharing shelters with conspecifics, while females fare better alone.

P1.75 G. KAREN GOLINSKI AND LORI D. DANIELS. Department of Geography, University of British Columbia, Vancouver, B.C. <u>Bryophyte communities in closed-forest and natural canopy gaps in old-growth coniferous forests of Coastal British Columbia, Canada</u>

Forest floor bryophyte cover, diversity, and community composition were assessed in closed-canopy old-growth coniferous forests and in natural canopy gaps in two sites in Bamfield—on the outer west coast of Vancouver Island, British Columbia—and in three watersheds in the Lower Mainland of B.C. Mean cover, diversity, and species richness of bryophytes were all greater in both forest and gap plots in Bamfield than in forest and gap plots in the Lower Mainland watersheds. Cover and species richness of bryophytes was greater in natural canopy gaps than in closed-canopy forest in both regions. Major differences in bryophyte community composition were noted between the two regions. These appear to be related to the high, stable humidity of the maritime climate and the greater surface area of decaying wood on the forest floor in the Bamfield sites. Differences in canopy openness between closed-forest and natural canopy gaps are relatively small and seem to have less influence on forest floor bryophyte communities than other factors.

P1.76 EVAN DAVIDSON, ANDREW ELLIOTT, AND R. MALIA FINCHER. Samford University. Impacts of acorn weevils on five oak species in Oak Mountain State Park, AL

Oak Mountain State Park (OMSP) in Shelby County, AL suffers from poor forest regeneration. Acorns are highly utilized by primary consumers, and the magnitude of this utilization is an important determinant of forest structure. Acorn weevils, as a major seed predator, have been implicated as a primary cause of oak regeneration failure. In order to determine the magnitude of acorn weevil impact on oak regeneration in OMSP, we conducted a survey of weevil predation of acorns of 5 species of oak. Since acorn weevil effects vary annually, from high to low infestation rates, we measured the effects of weevil predation on the level of individual acorns and on the level of individual oak trees for each oak species. Also, we wanted to investigate if acorn infestation proportions were consistent among oak species. We determined that the overall infestation rate for acorns was approximately 31% and the mean percent infested acorns per tree was approximately 44%. We found significant differences among oak species. The predator satiation theory best explains percent infestation and acorn crop sizes. Red and post oaks, being in a nonmast year, had the lowest acorn crop but the highest percent infestation, and chestnut, black, and white oak species, being in mast years, had the largest acorn crop and the lowest percent infestation. Acorn weevils are a probable reason for the park's poor regeneration, and prescribed forest fires would best curb weevil levels and boost seedling recruitment.

P1.77 BAL K NEPAL AND GARY L WALKER. Appalachian State University. Characterization of the vegetation community associated with *Juniperus virginiana* L. stands in the talus area of cliff systems in the Obed Wild and Scenic River Gorge, Tennessee.

The cliff systems in the Obed Wild and Scenic River Gorge support diverse plant communities including many old growth ancient red cedars (*Juniperus virginiana* L.). We examined the age-class distribution of ancient red cedar, and also assessed the vegetation composition associated with the red cedar stands in the talus regions of North Clear Creek and Obed Wall. The age-class distributions for populations of red cedar have shown that a large number of trees are below 100 years old. It gives the notion that continuous seedling recruitment has been occurring for red cedar. Altogether, 140 different vascular plants were found associated with North Clear Creek and Obed Wall red cedar sites. Out of 140 species, 23 species were common on both sites. A total of 43 different species of lichen, and 20 bryophytes were also found associated with red cedar. Most of the lichens and mosses were epiphytic on the red cedar trees. It shows that the talus regions of the cliff systems could be the best reservoirs for plant communities.

P1.78 NICHOLAS LEVELSMIER¹, PAULA C. JACKSON¹, THOMAS MCELROY¹, CASANDRA REYES-GARCIA², JOSE LUIS ANDRADE², JUAN MANUEL DUPUY². Kennesaw State University¹, Centro De Investigación Científica De Yucatán². Exploring Tree Species Diversity in the Yucatan Peninsula of Mexico.

Although tropical dry forests are some of the most endangered ecosystems on the planet, they have been studied much less than their humid counterparts. In this preliminary study we compared two areas of tropical dry forest on the Yucatan Peninsula of Mexico - Dzibilchaltun and Kiuic- that differ in moisture availability. The Dzibilchaltun site is located near the north coast and receives significantly less rainfall than the Kiuic site, which is located further south and more inland. We hypothesized that moisture availability would affect diversity, and predicted that the site with greater moisture (Kiuic) would also present greater diversity. Using 10 x 10 m² quadrats and identifying all trees above 5 cm circumference, we constructed species area curves for each site, and calculated Shannon Diversity and Sorensen Similarity indexes. Our results indicated a Shannon diversity index for Kiuic of 2.91, whereas for Dzibilchaltun it was 2.30. Based on Sorensen's similarity index, sites presented only a 40% similarity.

P1.79 HAYDEN SELF, JOSHUA W. CAMPBELL, AND MATTEW WATERS. Shorter College. Paleoecology of Okefenokee Swamp Based on Diatoms from Short Cores.

Diatoms can be used as indicators of climate change and other ecological changes. Two short cores of peat/sediment, obtained via a piston corer, were taken in the southeastern swamp prairie of the Okefenokee Swamp and analyzed through standardized methods to reveal ecological/climate variations based upon diatom assemblages. These diatom assemblages, analyzed at each individual centimeter sub-section of each core, are a standard and reliable way to reveal fluctuations in nutrients, water levels, and other hydrological aspects of Okefenokee Swamp. It was revealed through variations in the absolute and relative abundances of individual species found in each core that significant hydrological changes have affected this area of the Okeefenokee throughout its history.

P1.80 VIRGINIA CROSBIE, ALLYSON SCHMIDT, and CHARLES GUNNELS. Florida Gulf Coast University. The effects of bidirectional parental care on the endobiotic community in the paper wasp, Mischocyttarus mexicanus.

Endobiotes are organisms that live within a host. The mode of transmission can influence the relationship between the host and endobiote. For example, termites cannot digest wood without the protozoan Trichonympha. Trichonympha has a cooperative relation with its host because the endobiote is transmitted equally to all individuals of a colony making all hosts equally valuable to the endobiote. By comparison, Wolbachia parasitize the host by altering the sex ratio of offspring, converting males into females. Wolbachia parasitizes because it is transmitted through the maternal germline making females the only viable hosts. The paper wasp, Mischocyttarus mexicanus, shows a unique form of parental care. Adults feed larvae prey, which larvae digest. Larvae then feed adults a liquid diet through salivary secretions. This bidirectional care as well as reproductive asymmetry among adults provides multiple pathways for endobiotic transmission and the potential for both cooperative and parasitic endobiotes. Adult and larva gastrointestinal tracts were cultured on selective media. The endobiotic communities were significantly different between larvae and adults. The difference in endobiote diversity appears to reflect the transmission of food among wasps. Endobiotes within larva gastrointestinal tracts appear to be involved in digestion of food received from adults. For example, larvae, but not adults, possessed β-hemolytic endobiotes, which are likely involved in prey digestion. By comparison, the endobiotes in the adults showed a lack of diversity, which may reflect the simple structure of the salivary secretions consumed by adults.

P1.81 MORGAN MARSH AND VLADISLAV GULIS. Coastal Carolina University. The role of microorganisms in the decomposition of *Spartina* wrack in coastal ecosystems.

Spartina wrack has not been studied extensively even though the accumulation of material in salt marshes can be considerable. In this study, we addressed: (1) decomposition rates of Spartina alterniflora wrack along the salt marsh elevational gradient; (2) the relative importance of fungi vs. bacteria on Spartina wrack; (3) the differences in fungal community structure between standing dead Spartina and Spartina wrack. Four study sites in the salt marsh at Baruch Marine Field Lab (BMFL) in North Inlet, SC were used. Each had 4 sampling stations (treatments) along the elevational gradient: subtidal, intertidal, high marsh and terrestrial. Decomposition rates of Spartina in litter bags, associated microbial respiration, fungal and bacterial biomass (from ergosterol and epifluorescence microscopy, respectively) were followed over ten months (March-December 2009). Fungal community structure was assessed by DGGE. We saw the decrease of wrack decomposition rate along the elevational gradient (low to high marsh) and considerably higher fungal than bacterial biomass in all treatments. Patterns of microbial biomass and respiration through time differed among treatments. Fungal communities on Spartina wrack were surprisingly diverse, with more than 20 phylotypes per sample routinely detected.

JAMIE CRIST, H. DAWN WILKINS, AND LINDA K. HUSMANN. University of Tennessee at Martin. <u>Characterization of cellulolytic bacteria from the digestive tract of a Yellow-bellied Sapsucker (Sphyrapicus varius) and the guts of eastern subterranean termites (Reticulitermes flavipes).</u>

Yellow-bellied Sapsuckers (Sphyrapicus varius) excavate into trees creating sap wells that they use to obtain sap during the summer months. During the winter, they continue to excavate sap wells, but since the trees are dormant, there is very little movement of sap. This woodpecker species is known to ingest phloem from dormant trees, and therefore we have hypothesized that Yellow-bellied Sapsuckers carry bacteria in their digestive tracts that break down cellulose. We developed a hybrid medium used to screen for cellulolytic activity and tested it by assaying bacteria from the guts of eastern subterranean termites (Reticulitermes flavipes). Utilizing aerobic incubation, we assayed 88 isolates and found 9 to be cellulolytic bacteria. From the digestive tract of a salvaged female Yellow-bellied sapsucker, we assayed 115 isolates and found a minimum of 43 to be cellulolytic. These isolates have been characterized using standard staining and biochemical techniques. Preliminary sequencing of the gene encoding 16S rRNA indicates that these cellulolytic isolates include at least 5 different species. The Gram- positive species appear to be in the genera Bacillus, Paenibacillus, and Microbacterium while the Gram-negative species appear to be in the genera Erwinia and Pantoea. We found similarities between the cellulolytic flora of the termite and the sapsucker.

P1.83 MARY JANE CARMICHAEL¹, SARAH CARMICHAEL², LEIGH ANNE ROBLE², AND SUZANNA BRÄUER¹. Departments of Biology¹ and Geology² Appalachian State University. Geomicrobiology of Mn Oxide Deposits in Eastern Tennessee Caves.

Tennessee contains 1/6 of known caves in the United States, yet a paucity of information exists regarding the geomicrobiology of these subterranean systems. Carter Salt Peter Cave (Carter County, Tennessee) contains a variety of Mn-oxide deposits, which are typical of karst systems of the southern Appalachians. Evidence of microbial activity in these deposits is visible in the form of biofilm coatings on cave walls and in a black/chocolate brown patina coating the surface of rocks. Leucobeurbelin Blue (LBB)

field tests for bacterial Mn(II)-oxidation yielded strong positive reactions for all samples collected. ICP analyses of available Mn and Fe were conducted using biofilm material from a muddy substrate called Mn Falls. ICP data supported LBB test observations by revealing an unusually high Mn:Fe ratio (1:1) for the biofilm material compared to previous studies conducted on wetland and deep sea biofilms, where Fe dominates. Mn-enrichment cultures have produced isolates of several putative Mn-oxidizers, whose partial SSU rRNA sequence fragments most closely matched those of Pseudomonas and two genera not previously known to have members capable of Mn oxidation, Flavobacterium and Janthinobacterium. DNA sequencing coupled with ARB, PHYLIP, and DOTUR analyses of two samples from the biofilm revealed the presence of diverse bacterial communities. Using a 97% identity cut off, there were 114 unique operational taxonomic units (OTUs/"species") out of 180 total sequences with 65 unique OTUs in each ca. 90 sequence library. Several of the 34 dominant OTUs from the site were related to known Mn oxidizers including Pseudomonas and Leptothrix.

P1.84 JESSICA PARKER, STEPHEN CURRAN, AND ROBIN OVERSTREET. The University of Southern Mississippi. <u>Comparison of endohelminth parasite assemblages of the redear sunfish, Lepomis microlophus, from freshwater habitats and tidal creeks in southern Mississippi.</u>

The redear sunfish occurs in every freshwater drainage basin in Mississippi and is able to withstand fluctuating salinities more efficiently than most other centrarchids. Consequently, in addition to strictly freshwater habitats, the species occupies tidal creeks with salinity concentrations that fluctuate from 0-11 ppt in coastal drainages. This study compares the endohelminth parasite assemblages of redear sunfishes from 3 strictly freshwater habitats and 4 tidal creeks in coastal counties in Mississippi. Fish of various sizes were collected irregularly from the 7 localities using hook and line, hoop nets, and cast nets in 2009. Parasites were removed from each host, preserved and counted as accurately as possible. Collected endohelminths comprised one larval and one adult acanthacephalan, 8 larval and 6 adult digeneans, 3 larval and 2 adult nematodes, and one larval cestode. Trends in the assemblage suggest that redear populations are not particularly vagile and that there appears to be a clear difference in the assemblages of endohelminths between freshwater habitats and tidal creeks. The differences are likely attributed to parasites coevolving with intermediate hosts that are restricted to one habitat or the other. Funding was from NSF Award No. 0529684 and NOAA award No. NA08N054730322.

P1.85 ALISON CAREY AND MATTHEW KLUKOWSKI. Middle Tennessee State University. Home Ranges of the Eastern Fence Lizard (Sceloporus undulatus).

We used radio-telemetry to study the spatial activity of adult Eastern Fence Lizards (*Sceloporus undulatus*) during the late summer and fall (September to November) in a cedar-oak-hickory forest of middle Tennessee. In addition to determining home-range sizes, behaviors such as movement frequency, orientation (e.g., head up or head down), perch height and diameter were recorded and related to weather. Home range areas averaged 189 m^2 with core areas averaging 39 m². Lizards were often observed returning to exactly the same locations in spite of long distance excursions to other areas. Perch heights averaged 2.8 meters but lizards were occasionally observed 20 meters high. Some interesting natural history findings include the use of very small perch diameters by lizards as well as their lack of seeking cover during rainy periods. There were no significant sex differences in any of the variables examined though sample sizes were small. Our results are thus consistent with the hypothesis that male and female home range sizes will be similar in nonbreeding seasons.

P1.86 LYNEA R. WITCZAK, LAUREN E. SEAY, STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College. <u>The effects of urbanization on reproductive success and juvenile survivorship in semi-aquatic turtles.</u>

Turtle reproduction and recruitment may be susceptible to anthropogenic activities such as housing developments and road construction. Because turtles are characterized by high survivorship and long life spans, it is necessary to examine egg production and juvenile populations to determine immediate impacts of urbanization. The objectives of this study were to determine whether observed clutch sizes varied from published data, determine the percentage of gravid females at study sites, determine whether clutch sizes and egg widths varied among study sites, examine the relationships between turtle size, clutch size, and egg width and determine the most effective method for trapping juveniles. Species used in this study include Chrysemys picta, Trachemys scripta, Kinosternon subrubrum, Chelydra serpentine, Pseudemys concinna and Sternotherus odoratus. Hoop traps and box traps were set in six ponds and checked every other day throughout three 20-day trapping periods. All turtles were given a 3-4 digit code, and specific measurements were taken of individuals. Females were taken to a veterinarian and xrayed for eggs. Eggs were counted and measured using eFilm Lite™ software. Linear regression and chi-square were used to analyze data. Clutch sizes did not vary significantly from published data. Clutch sizes and average egg width did not vary among rural and urbanized ponds. Turtle size did not affect clutch size or egg width. Box traps were more effective in capturing juveniles than hoop traps. Hoop traps were more effective in capturing adults. Juvenile studies should be continued to better understand the effects of urbanization on turtle populations.

P1.87 MARIE COLSON^{1,2} AND THOMAS P. WILSON¹. University of Tennessee at Chattanooga¹, Tennessee Valley Authority². <u>Landscape Patterns and Patch Dynamics in Hamilton County, Tennessee, Over a Forty Year Period:</u>
Applicability to the Conservation of the Eastern Box Turtle (*Terrapene carolina*).

Exurban development is the fastest growing form of land use and the primary driver of habitat loss. Species with long generation times such as the eastern box turtle (Terrapene carolina) can persist in an urbanizing environment but often become functionally extinct. We quantify land cover change over a 40 year period by using orthorectified data in a direct linear transformation model. A GIS database was created for three study sites and landscape pattern analyzed to determine the effects of historic land use on the eastern box turtle habitat. A habitat loss model was created using the core patch metric along with life history traits. Spatial structure of fragmentation across time was characterized using autocorrelation statistics and residual analysis of ordinary least squares and geographically weighted regression. All three sites lost forest and agriculture and showed an increase in urban and transportation areas. Significantly 20% of the area of site 2 has been converted to urban land use since 1963. The rate of core forest loss at site 1 and 2 was decreasing but increasing at site 3 where the highest rate per year of core forest habitat loss was only 8% between 1997 and 2007. Rate of core habitat loss per year was decreasing at site 1 and 3 but increasing at site 2 which lost 6% between 1997 and 2007. These rates of habitat loss suggest that site 1 could sustain three generations of box turtles until all core habitat has disappeared.

P1.88 KEVIN MESSENGER¹ and JAYME WALDRON². Marshall University¹, University of South Carolina². Growth and age at reproductive maturity of the Carolina pigmy rattlesnake, Sistrurus m. miliarius (Reptilia: Serpentes).

Growth and age at reproductive maturity are two life history attributes that play an important role in the development of proper management protocols. The Carolina pigmy rattlesnake. Sistrurus m. miliarius, is one of two species of dwarf rattlesnake. It is highly

susceptible to predation and commercial collection due to its small size. In North Carolina, where the species is listed as threatened, most of its historic range has been destroyed by fragmentation and land development. Sistrurus m. miliarius is difficult to study due to its elusive behavior; thus little is known about its life history. We modeled growth and age at reproductive maturity for a population of pigmy rattlesnakes from a wildlife refuge in north central SC. This population is very stable and hence we felt it was an appropriate representation of a healthy population. We fit growth intervals (SVL) measured from free ranging pigmy rattlesnakes captured during a six-year mark-recapture study to the von Bertalanffy and logistic growth interval models. For each gender, the von Bertalanffy model estimated age at reproductive maturity at 2.7 years (\circlearrowleft) and 2.1 years (\updownarrow), and asymptotic size at 46.7cm (\circlearrowleft) and 45cm (\updownarrow); the logistic model estimated maturity at 3.4 years (\circlearrowleft) and 3 years (\updownarrow), and a total length of 45.2cm (\circlearrowleft) and 43.9cm (\updownarrow). These results are significant because it shows that pigmies have a very "fast" life history, when compared to other pit-vipers; understanding these aspects of their life history is essential to a sound management plan.

P1.89 TIFFANY BURGESS, MICHELLE CALVO, ULI UMBEHR AND KATHRYN STEPHENSON CRAVEN. Armstrong Atlantic State University. The Effect of Temperature on the Growth of Hatchling Carolina Diamondback Terrapins (Malaclemys terrapin centrata) Raised in Captivity.

The diamondback terrapin is native to the coastal brackish waters of the Atlantic and Gulf states in the US. Nesting occurs from May through July and eggs incubate for about 60 days. This project was designed to test the effect of temperature on the growth of hatchling terrapins and assess the potentially positive effect of global warming on reptiles. One clutch of captive bred Carolina diamondback terrapin hatchlings was divided into 2 treatment groups (N=4 turtles). Both treatments were maintained in the laboratory, the first at 26 C and the second treatment was in a separate tank at 28.5 C. Both tanks were otherwise identical. Hatchlings were fed individually at ambient temperature four times per week. Weekly measurements of weight, straight-line carapace length and width (SCL and SCW), plastron length and width as well as shell depth were recorded for 18 weeks along with periodic photo-documentation. An overall trend of greater growth was observed in the warmer tank, although there were some individual differences in growth rate.

P1.90 JERROD SHIPMAN¹ and EILEEN UNDERWOOD². Middle Tennessee State University¹, Bowling Green State University². <u>Incubation temperature affects offspring sex in Rhacodactylus ciliatus</u>.

The effects of incubation temperature on developing embryos may have important implications on sex, development and growth in geckos. We incubated eggs of the Crested Gecko (*Rhacodactylus ciliatus*) at 5 constant temperatures (31, 29, 28, 26, 24 °C). Measurements were taken to test for the effects of embryonic thermal environment on incubation duration, hatching success, hatchling mass, and sex ratio. Incubation duration (ID) decreased linearly as temperature increased. Eggs incubated at 29° and 31°C had lower hatching success than other temps tested while hatchlings incubated at 31°C were significantly smaller than hatchlings incubated at 29-26°C. *R. ciliatus* exhibits evidence of temperature dependent sex determination type IB. Given that hatchlings incubated at 26°C were significantly larger upon hatching than the extreme temperatures, and the sex ratio of 26°C being almost 1:1, artificial incubation of *R. ciliatus* at a constant 26°C could be used as the optimal method of incubation for any reintroduction programs aiming to repopulate the New Caledonian islands.

P1.91 JEFFREY D. CAMPER. Francis Marion University. <u>Spatial ecology of the Common Kingsnake (Lampropeltis getula)</u> in the South Carolina Coastal Plain.

I studied the spatial ecology of *Lampropeltis getula* using radiotelemetry from 2002 to 2006. Six (three female, three male) *L. getula* from Clemson University's Pee Dee Research and Education Center (PDREC) in the upper coastal plain in Darlington County had transmitters surgically implanted in them. I attempted to locate the snakes five days per week in the summer and 2-4 days per week during the fall. Minimum convex polygon (MCP) home ranges averaged 2.68 ± 2.78 ha (range 0.84-8.26 ha). Range lengths of the MCPs had a mean of 392 ± 300 m (range 231-999 m). Movement distances averaged 90 ± 54 m (range 57-196 m) per move. Overall movement rate (total distance/number days tracked) had a mean of 18.1 ± 5.43 m/day. Actual movement rate (total distance/number days snakes moved) averaged 91.5 ± 54.11 m/day. Snakes were found at new locations on an average of $47.7\pm17.3\%$ of fixes.

P1.92 NATHAN SHEPARD¹, JAYME WALDRON², CATHERINE JOHNSON³, AND THOMAS PAULEY¹. Marshall University¹, University of South Carolina², United States Forestry Service - Monongahela National Forest³. The Edge Effects of Gated Roads and Trails on the Survivorship of *Plethodon nettingi*.

Amphibian declines are a global epidemic in which a multitude of factors are involved, leaving many species of amphibians vulnerable to extinction. Habitat fragmentation is a global threat to amphibian populations, with local implications for amphibian declines. In West Virginia, many plethodontid salamander populations are fragmented by various manmade edges that transect throughout their habitats, which act as barriers to salamander movement. Habitat fragmentation can indirectly affect plethodontids by altering plant diversity, soil moisture, and prey availability, limiting resources and strengthening the barrier to movement and distribution. The federally threatened Cheat Mountain Salamander (Plethodon nettingi) has suffered from habitat loss and fragmentation, which isolated populations. The goal of this study is to assess the effects of gated roads and recreational trails on P. nettingi movement, abundance, and survivorship. We collected mark-recapture data using cover board arrays at study sites that were constructed along the following treatments: gated roads, low-use hiking trails, and high-use hiking trails, and experimental controls. In 2009, we captured 78 P. nettingi at a 23% recapture rate. We will present survivorship models developed using program MARK. Results from this study will be used to develop protocols for the United States Forest Service to minimize the impact of gated roads and recreational-use trials on *P. nettingi* populations.

P1.93 THOMAS P. WILSON, CHRISTOPHER B. MANIS AND MARK SCHORR. University of Tenneessee at Chattanooga. Sex Ratios and Size Dimorphisms in the Tennessee River Gorge Turtle Community.

An assemblage of riverine turtles in the Tennessee River Gorge was sampled from 2000 to 2006 to ascertain aspects of their community ecology and morphological variation within specific populations. Significant disparities in adult sex ratios were observed within the populations of *Trachemys scripta troosti* (2.73:19), *Sternotherus odoratus* (1.73:19), and Chelydra serpentina $(4.2 \stackrel{?}{\circ}:1)$, as they were in favor of males. Populations of Pseudemys concinna (1.23:19), Chrysemys picta (1.33:19), and Graptemys ouachitensis (1.3♂:1♀) did not differ significantly from equality (1♂:1♀). Sexual size dimorphisms were observed among the five emydid species that were collected, with mature females attaining significantly larger body sizes in all body size measurements relative to males. Mature male C. serpentina were significantly larger in only two body measurements: carapace length and plastron length. Significant sexual size dimorphism among the kinosternids (S. odoratus) was observed only in regards to head width, as the sexes were similar in body size proportions. Generally, the sampled turtles of the TRG averaged larger in body sizes than those that have been reported from other populations in the United States. Male S. odoratus in the TRG averaged significantly larger in carapace length (106.91±9.42 mm) than any other population reported upon. The largest male and female individuals *S.* odoratus in the TRG achieved 131 mm CL and 133 mm CL respectively, approaching the size record of this species (137mm CL; Conant and Collins 1998).

P1.94 CHRISTOPHER MANIS, THOMAS P. WILSON AND MARK SCHORR. University of Tenneessee at Chattanooga. Relative Abundance and Species Richness of Aquatic Turtle Species in the Tennessee River Gorge.

A study was carried out from 2000 to 2006 to determine the community structure of a riverine turtle population in the Tennessee River Gorge (TRG), a 42 kilometer stretch of the Tennessee River. A total of 3,197 turtles was captured, with a total of 136 recaptures for all species. *Trachemys scripta* was the most abundant Emydid and species (69.4%) collected. Other Emydids including: *Pseudemys concinna* (10.2%), *Graptemys ouachitensis* (2.9%), *Chrysemys picta* (1.0%), and *G. geographica* (0.7%), were observed less often. Kinosternid species, *Sternotherus odoratus* (11.8%) and *S. minor peltifer* (0.2%), were detected. Representatives of the families Chelydridae and Trionychidae were observed by one species each, with *Chelydra serpentina* (3.8%) and *Apalone spinifera* (0.1%) being collected, respectively. *Trachemys scripta troosti*, was historically described as being "in need of management," but was the most abundant turtle (N = 2218) during this study. The Shannon-Weiner Index (N₁ = 2.91) and Smith and Wilson's E (E_{var} = 0.158) values indicate that community heterogeneity and evenness was lacking in the TRG turtle community, due to numerical dominance of *T. scripta troosti*.

P1.95 JOSEPH F. SIMPSON III AND THOMAS P. WILSON. University of Tennessee at Chattanooga. <u>Community Structure</u>, <u>Life History and Demography of pondbreeding salamanders at an isolated wetland in Hamilton County</u>, Tennessee.

In October 2007, we initiated a long-term ecological study of small vertebrates, mostly for pond-breeding salamanders (Ambystomatidae) and other amphibians, at a small isolated wetland in Hamilton County, Tennessee. Because of upland habitat loss, the amphibian community that utilizes this wetland may be in peril. The local status, distribution and basic life-history features and demography have not been well studied. We captured, measured, individually marked, and released 3,306 breeding adults that were comprised primarily of two species (A. opacum, and A. maculatum) and 696 newly metamorphosed juveniles (primarily A. opacum) at the drift fence encompassing this wetland. We also used relative abundance and mark-recapture to investigate community structure. Numbers of breeding adults and annual juvenile production varied across years. Mark-recapture data indicate that female A. maculatum are sexual maturity at an average body size of 104 mm SVL and males are slightly smaller with a SVL of 99.1 mm; however, body sizes for female A. opacum (SVL 69.3 mm) are only slightly larger than males (SVL 68.11 mm). Generally, less than 50% of individuals were recaptured at the wetland a second time and these data might suggest that this salamander community was under pressure by exurban development and could serve as a reproductive sink during the duration of this study. Furthermore, land use and planning agencies should be sensitive to the fact that isolated wetlands may be insufficient for the long-term sustainability of viable populations of pondbreeding salamanders or other small vertebrates.

P1.96 REBECCA DONALDSON AND KRISTIN BAKKEGARD. Samford University. <u>Tail length and SSD in Desmognathine salamanders</u>.

The contribution of tail length to sexual size dimorphism (SSD) in salamanders is relatively unstudied. Salamander tails are used for energy storage, courtship, antipredator defense and respiration but differences in life-history strategies between males and females may generate SSD in this trait. Because the basal member of the Desmognathine salamanders, *Phaeognathus hubrichti*, shows SSD in tail dimensions (females have long

thin tails compared to males shorter, thicker tail), we hypothesized that other desmognathines may follow the same pattern. We took standard morphological measurements, aged and sexed 342 *Desmognathus quadramaculatus* (the largest species of *Desmognathus*) and 244 *Desmognathus aeneus* (one of the smallest species) to determine whether SSD in tail length followed the same pattern as *P. hubrichti*. Neither species showed SSD in tail length but males of both species had significantly wider tail diameters than females. Females had a significantly longer distance between limbs than males. Both species were same as *P. hubrichti* in showing male biased SSD in head width. We also found that all three species differ in resource allocation to different body parts as they mature. This suggests that life-history traits and ecological requirements have a stronger influence on body size than phylogeny in this group of salamanders.

P1.97 CHARLES YEAGER AND MEGAN GIBBONS. Birmingham-Southern College. Maternal provisioning trade-off strategies of *Agalychnis callidryas*.

The trade-offs associated with various maternal provisioning strategies in amphibians is well documented. Female size is expected to be positively correlated with resources available for offspring. Strategies for increased maternal resources include increasing the size of the clutch (i.e., number of eggs) or increasing individual egg size. Females sometimes produce clutches with varying egg sizes (bet-hedging). For this study we examined the provisioning strategy employed by female red-eyed tree frogs (Agalychnis callidryas). We recorded female mass, individual egg diameter, total yolk volume, and total eggs laid from 31 amplexed pairs of frogs. Female mass had no significant relationship with total yolk output or total number of eggs, but had a positive significant relationship with egg diameter. A posteriori tests showed that there was a significant difference between the largest and smallest eggs within clutches, and that clutches differed in their amount of egg size variation. While in general, larger females invested in larger, rather than more eggs, females with greater within-clutch egg size variation employed a bethedging strategy. These data suggest that a combination of maternal provisioning strategies are present in this population of A. callidryas, which is likely an adaptive response to an unpredictable and predator-rich environment.

P1.98 JAKE KRIEGER, JOSHUA MITCHEM, AND CARLOS D. CAMP. Piedmont College. Niche Partitioning between Two Cryptic, Sympatric Species of Desmognathus.

Niche shift in response to potential competition and/or predation has been hypothesized as a primary determinant of spatial relationships among dusky salamanders (Desmognathus) in Appalachian streams. We tested this hypothesis with regards to two cryptic species (D. quadramaculatus and D. folkertsi) that occur sympatrically in northern Georgia. We specificially determined if presence of the other congener affected choice of macrohabitat (stream size) and microhabitat (distance from running water, size of cover object, bank vegetation). We used time-constrained searches to determine relative abundance of each species in large streams (mean bed diameter = 5.6 m) versus small tributaries (bed diameter = 2.3 m) in watersheds where each species occurs allopatrically and where both occur sympatrically. We measured microhabitat variables for each salamander observed. Analysis of variance showed that in allopatry, there was no difference in salamander abundance between large and small streams. However, the two species experience a distinct habitat shift in sympatry. When occurring together, D. quadramaculatus dominates large streams, and D. folkertsi dominates small. There was, however, no significant shift in microhabitat. Because the total number of salamanders did not differ among watersheds, we can infer that each stream is at its carrying capacity and. therefore, competition for limited resources or active avoidance of the other congener is driving the observed shift in macrohabitat.

P1.99 HEATHER RHEN,¹ ZACH FELIX,¹ AND JESSICA WOOTEN². Reinhardt College¹, University of Findlay². Phylogenetics of the Black Mountain salamander, *Desmognathus welteri*.

It is becoming increasingly clear that the Southern Appalachian Mountains harbor a surprising amount of cryptic biodiversity in the salamander family Plethodontidae. The Cumberland Plateau is relatively unexplored in this regard and we predicted that the Black Mountain salamander (*Desmognathus welteri*) would also harbor old and well-differentiated clades. Preliminary sampling in the summer of 2009 yielded tissue from a majority of this species' range. Sequences totaling approximately 1200 base pairs for the 12S valine transfer and cytochrome oxidase I portions of the mitochondrial genome were analyzed to create a phylogenetic hypothesis to delimit evolutionary relationships within this group. Maximum likelihood and Bayesian methods were used to reconstruct the phylogeny. Genetic diversity was highest in the southern portion of the species range and we found some support for a paleodrainage effect and have identified areas which potentially served as refugia during the last glacial maximum. Further sampling and sequencing may reveal additional unique evolutionary lineages within this group that merit naming of new species.

P1.100 KAYLA SMITH, GEORGE CLINE, MARK MEADE, AND CHRIS MURDOCK. Jacksonville State University. <u>Studies on the population dynamics of freshwater turtles and the genetic variation of eastern spiny softshell turtles (*Apalone spiniferus*) in Cane Creek Anniston, Alabama.</u>

The softshell turtle has restricted movement between populations due to their leathery skin, interbreeding between populations requires adjacent bodies of water (Dunson 1986; Mount 1975; Weisrock and Janzen 2000). In 2000, Weisrock and Janzen compared the mtDNA of turtles in the North, Southeast, West and Northwest. Weisrock and Janzen only had one specimen from Alabama. We wanted to address a few questions: (1) Are the turtles in northeast Alabama phylogenetically similar to the specimen from Macon County Alabama used in Weisrock and Janzen's research? (2) Are the turtles in northeast Alabama phylogentically similar to the Southeast clade 1 or Southeast clade 2 used in the Wesirock and Janzen's research? In order to answer our questions we surveyed turtles from June 27, 2008-June 27, 2009 at four sites which were located on the Cane Creek Golf Course in Anniston, Alabama. After a softshell turtle was captured, it was brought back to Jacksonville State University to obtain a blood sample. Genomic DNA was isolated from three Apalone spinifera individuals as per manufacturer's instructions using a QIAgen micro DNA extraction kit. PCR was conducted per Weisrock and Janzen 2000. Primers amplified an 800-bp fragment of the mitochondrial cytochrome b gene. PCR product was run on a 1.5% low-melt agarose TBE gel (50mL 0.5x TAE Buffer, 0.4g agarose, and 2mL EtBr 10mg/mL) and the target DNA fragment was then excised. The fragment was suspended using manufacturer protocol in the QIAquick Gel Extraction Kit. Sequencing was conducted and the data was analyzed using phylogenetic software.

P1.101 MARLA L. ANZALONE, DANIEL P. JACKSON, KATHERINE J. VENABLE, and KEVIN M. GRIBBINS. Wittenberg University. <u>Spermatid Ultrastructure within the Seminiferous Epithelium of the American Alligator</u>, *Alligator mississippiensis*.

To date, few studies detail the ultrastructural development of spermiogenesis within crocodilians. The purpose of this study was to gain a better understanding of spermiogenesis within *Alligator mississippiensis*. Six adult male alligators were collected from Rockefellar Wildlife Refuge in Lake Charles, Louisiana, in May of 2003. Testes were removed, fixed in Trumps fixative, and pieces of testis were processed for TEM. Preliminary analysis reveals that spermiogenesis is very similar to *Caiman crocodylus* and surprisingly, the turtles *Pelodiscus sinensis* and *Pseudemys scripta*. The round spermatids

undergo acrosomal development after meiosis in alligators. The acrosome vesicle develops from the Golgi, similar to other reptiles. The nucleus begins elongation after the acrosome complex has formed, and the shape of elongates are aberrant and not uniform or straight as in other reptilian taxa. The flagellum develops late in round spermatids and continues to elongate from the distal centriole during elongation. The acrosome collapses and migrates over the surface of the nuclear rostrum to form prominent acrosomal shoulders laterally. A distinct endonuclear canal forms during elongation and continues to differentiate and penetrate deep into the nucleus during elongation. A very prominent manchete forms during elongation similar to other reptiles. A mitochondrial sheath forms around the axoneme of the midpiece. The ultrastructural features of spermiogenesis in the American Alligator are highly conserved with that of other crocodilians. The morphology of the spermatids in the alligator also suggests that chelonians may share a phylogenetic kinship with Archosaurs, which has been suggested by recent molecular data.

P1.102 MALLORY CASTLEBERRY¹ ZACH FELIX¹ AND JESSICA WOOTEN². Reinhardt College¹, University of Findlay². Morphological variation in the Black Mountain salamander, Desmognathus welteri.

Intraspecific variation in morphology has been related to behavior, ecology, and climate, and can be an indication of undocumented cryptic sibling species. We studied the morphology of *Desmognathus welteri* (Black Mountain salamander) using museum specimens from 8 counties in Kentucky, West Virginia, Virginia and Tennessee. We used digital photos and tpsTree software to measure 12 linear distances on each of over 150 specimens. These distance measures were reduced to 3 factors using factor analysis and varimax rotation. We detected some latitudinal patterns in morphological variation, but it appears that this species, like other Plethodontids previously studied, are morphologically conservative. In the future we plan on combining these morphological data with a phylogenetic study to compare the two datasets.

P1.103 MOLLY COMISKEY, ¹ ZACH FELIX, ¹ AND JESSICA WOOTEN². Reinhardt College¹, University of Findlay². Geographic variation in dorsal color pattern of the Black Mountain salamander, *Desmognathus welteri*.

The Black Mountain salamander is a large semi-aquatic salamander endemic to the streams of the Cumberland Plateau. Little is known about the species in general including variation in the species' morphology across its range. We used both photographs of live specimens and museum specimens taken from 5 counties in Tennessee, Kentucky, West Virginia, and Virginia to classify and compare patterns of dorsal coloration. Our system of coding was modified from one developed by J.E. Juterbock. As predicted, color patterns varied highly and differed as much within a county as among geographically separate counties. We will discuss observed patterns and relate them to natural selection for local conditions. Our results are consistent with other similar studies of salamander color pattern variation.

P1.104 ANDREA N. DRAYER and STEPHEN C. RICHTER. Eastern Kentucky University. Comparison of amphibian communities in artificial and natural ponds in forested ecosystems.

Habitat loss plays a key role in the decline of amphibians worldwide. To mitigate loss of wetland habitat, artificial ponds are often constructed. The objective of our ongoing study is to determine the effectiveness of constructed wetlands by comparing natural and artificial ponds. For our study, artificial ponds were defined as being constructed within the last 25 years, while natural ponds were natural or created/modified >> 50 years ago. Five forested natural ponds and five forested artificial ponds in the Daniel Boone National Forest, Kentucky were sampled for amphibians by dipnetting, minnow trapping, visual

encounter surveys, and drift fence surveys from February through July 2009. Pond characteristics were measured including hydroperiod, canopy cover, aquatic vegetation, water quality, and temperature. Preliminary data suggest less fluctuation in pond level, longer hydroperiod, less shallow littoral zone, and more aquatic vegetation in artificial ponds when compared to natural ponds. Although artificial ponds consistently had higher species richness, species composition varied among ponds. Species composition was influenced by habitat requirements of individual species. For example, species that require longer hydroperiods for development of larvae, including *Notophthalmus viridescens* (redspotted newts), *Rana catesbeiana* (American bullfrogs), and *Rana clamitans* (green frogs) were more abundant in artificial ponds; while species with specialized breeding habitat requirements, including *Ambystoma opacum* (marbled salamanders) and *Hemidactylum scutatum* (four-toed salamanders), were observed more often in natural ponds. Results of our study will provide useful information for land managers to improve constructed habitats and to increase success of future amphibian habitat enhancement and mitigation projects.

P1.105 CHARLES R. LAWSON. Western Carolina University. <u>Habitat Characteristics</u> and <u>Biometrics of the Eastern Hellbender (*Cryptobranchus alleganiensis*) in Three Western North Carolina Streams.</u>

Cryptobranchus a. alleganiensis is listed as a species of special concern in the state of North Carolina and in most other states throughout its range. Little is known about how C. a. alleganiensis is affected by habitat alterations such as logging and development. I investigated whether adult C. a. alleganiensis total length, standard length, mass, tail fin height and tail diameter differed among streams having different degrees of alteration. I sampled three streams within the Upper Hiwasee drainage in North Carolina, selected based upon geographic and geologic similarity and the presence of C. a. alleganiensis. The streams differed in NC Division of Water Quality designation, D50 (median substrate particle diameter), and embeddedness (percentage of the substrate covered by fine sediments), all indications of surrounding land use. The selected streams included one reference, one heavily affected by sedimentation, and one of intermediate quality. Fortyeight C. a. alleganiensis were encountered during the study. Catch per unit effort of C. a. alleganiensis did not differ significantly among sites or streams. Cryptobranchus a. alleganiensis mass, mass corrected by standard length, and tail height corrected by mass were significantly higher in the intermediate-quality stream than in the other streams. Crayfish, a primary food source for C. a. alleganiensis, did not differ significantly among the streams in density, total carapace length, and mass. There were no significant correlations between the three crayfish biometrics and any C. a. alleganiensis biometric.

P1.106 R DEFFENDALL, A. STORIE, J. WEIMER, AND C. BELIN. Armstrong Atlantic State University. Whitetail deer carrying capacity at Skidaway Island State Park, Savannah, Georgia.

The native whitetail deer (*Odocoileus virginianus*) populations of several islands along the Georgia coast have appeared to be in declining health for the past 10 years. Several explanations for this phenomenon are evident; however, several researchers have alluded to the over-population of the species. We have determined the carrying capacity of the Skidaway Island State Park (SISP), a portion of Skidaway Island located near the coastal City of Savannah. By determining the amount of biomass produced by several habitats located within the park, and knowing the hectares of these habitats, the total amount of biomass has been determined. Using the caloric requirements of the whitetail deer found at various regions of the continental United States, we have been able to determine the sustainable carrying capacity of healthy deer within the park. This number was found to be 1 deer per 66 hectare (4 deer per square mile).

P1.107 RUSELL INGRAM AND OBINNA UCHIME. Department of Biology, Augusta State University. <u>Indications of genetic differences in plant development between two populations of Phacelia dubia var. Georgiana</u>

Phacelia dubia var. Georgiana (Hydrophyllaceae) is a biennial herb endemic to granite outcrops. On the periphery of an outcrop, a local population is located in a weedy area adjacent to Columbia Road in Appling, GA. This roadside population was in flower in March, 2009, whereas a nearby outcrop population isolated at Kiokee Creek flowered one month later. We hypothesized that this temporal change in flowering may be due to an adaptation for more rapid growth and early seed production in the weedy roadside area. In order to determine if there is a difference in growth patterns between the Columbia Road and Kiokee Creek populations, the two populations were grown together under the same environmental conditions. The results indicate that the Columbia Road population grows significantly faster and flowers several weeks earlier than the Kiokee Creek population. Thus, there is evidence of genetic change in growth, development and reproductive maturity in the population alongside Columbia Road. The change in plant development may have resulted from greater competition in the weedy roadside area versus the more barren granite substrate.

P1.108 KATHRYN STACKHOUSE AND LINDA NIEDZIELA. Elon University. <u>Developmental Toxicity of TCDD in Zebrafish.</u>

2,3,7,8-tetrachlorodibenzodioxin (TCDD) is an environmental toxin formed as a byproduct from the production of PVC plastic, waste-burning incinerators, and pesticides. It was found previously that early embryonic exposure of zebrafish (Danio rerio) to TCDD caused a decrease in swimming activity as dose increased. The purpose of this project was to determine the cause of this abnormality. It was hypothesized that TCDD exposure caused a structural difference in somite segmentation, a process leading to the development of vertebrae, skeletal muscles, and skin. In order to study this hypothesis, embryos were exposed to relevant concentrations of TCDD at the 8- to 16-cell stage. Somites were counted every four hours between 24 and 48 hours post fertilization. Digital pictures and videos were taken in order to measure degree of spine curvature and body length. During data collection, severe pericardial and yolk sac edemas were observed as well as failure of swim bladder inflation. Preliminary data were not significantly different for somite segmentation, spine curvature, or body length. After confirming negative results, edema and swim bladder inflation were pursued as potential mechanisms of toxicity. Preliminary data are promising. In the control group, there was no evidence of edema; however, severity of the edema increased significantly as dose increased. There was evidence of 100 percent swim bladder inflation in the control groups. Conversely, in the 1500, 2000, and 2500 ppt treatment groups, there was no evidence of swim bladder inflation. Continued data collection and analysis will focus on these morphological abnormalities to determine definite relationships.

P1.109 SUSIE BARRETT, MATTHEW WATERS, JOSHUA CAMPBELL, AND MAGHAN WOODS. Shorter College. Rome, GA. Recent paleolimnological history of primary producer assemblages in Okefenokee wetland system.

A transect of surface sediment cores (>1m) were collected across the Okefenokee Wetland to reconstruct historic nutrient inputs and changes in the primary producer community structure. Cores were photographed, sectioned and processed using standard paleolimnological techniques. Briefly, organic matter was assessed as loss on ignition and other fractions of sediment particles were measured using sieves. Phosphorus, nitrogen, organic carbon and sulfur were measured on each core section and serve as a proxy for nutrient inputs into the system. Photosynthetic pigments (chlorophylls and carotenoids) were measured using high performance liquid chromatography to serve as the proxy for

primary producer community structure. Furthermore, core section dates and sedimentation rates were determined by measuring excess ²¹⁰Pb using a germanium well detector. Core section dates and proxy changes were used to determine the driving factors controlling primary producer changes in the Okefenokee wetland system. Historic anthropogenic activities and inputs into the refuge (especially within the last 50 years) were correlated with our data.

P1.110 JAMES T. DONALDSON¹, TODD V. EASTIN², AND FOSTER LEVY¹. East Tennessee State University¹, Shady Valley, TN². Baa-tany Goat Project: a Grassy Bald Restoration Members' Cooperative.

The Baa-tany Goat Project is a volunteer-based program using Angora goats for restoring the globally-rare (G1) Grassy Balds on Roan Mountain, NC-TN. Roan's western balds predate European settlement. Current estimates suggest that >75% of its Grassy Balds have been lost in the last 100 years with most of that loss occurring in the last 50 years following US Forest Service acquisition and removal of livestock. The Post-Pleistocene Megaherbivore Theory, which is the basis for our project, proposes that large herbivores were the keystone factor maintaining the Grassy Balds since the last ice age and the movement of the natural treeline to the north. Goats, as browsers, selectively remove the woody plants invading the Grassy Balds. We will present the pre-treatment and first year browse vegetation monitoring results along 9 permanent transects with 55m² plots.

P1.111 TRAVIS PERRY AND ELIZA STUCKER. Furman University. A GIS analysis of 'the landscape of fear' created by puma (*Puma concolor*) for elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) in southcentral New Mexico.

The 'landscape of fear' refers to habitat selection by prey species that is influenced by predation risk. We used prey cache site location data for 6 GPS collared puma (*Puma concolor*) to determine whether predation on elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) was non-randomly distributed across habitat types. Prey cache sites were compared to randomly selected sites with respect to habitat variables elevation, slope, aspect, vegetation type, and topographic ruggedness using binary logistic regression. Prey cache sites differed significantly from random sites with respect to both slope and topographic ruggedness.

P2.1 CHRISTOPHER STEED¹, SANDY TRAIL¹, J. TODD FRENCH², AND BENJIE BLAIR¹. Jacksonville State University¹, Mississippi state University². Effects on survival of *Rhodotuorula glutinis* post electroporation with varied recovery media.

Worldwide use of fossil fuels has been continuously on the rise this decade with some reporting that this has been the fastest rate of increase in 16 years. An alternative to fossil fuels is microbial fuel sources. These lipids can easily be converted into bio-diesel fuels. *Rhodotuorula glutinis* is a mesophilic yeast that peaks interest because during production in conditions of low nitrogen starvation, there is an increase in intracellular lipid stores. Some researchers are using electroporation followed by centrifugation to remove the oil and maintain viable biomass. Many cells do not survive electroporation and die; therefore retaining biomass after electroporation would increase the cost effectiveness of the project. This study's objective is to identify ways to optimize the survival of the yeast post-electroporation. Cells were allowed to sit for five minutes after the electroporation at 1.5 kV, $25\mu F$, and 400Ω to simulate the oil recovery time. Cells were then transferred to a recovery medium treated with either vitamin B complex or yeast extract. The cells treated with yeast extract showed an increase in survival, while the cells treated with vitamin B complex showed a decrease in survival.

P2.2 JENNIFER PATTERSON AND LORI SEISCHAB. Western Carolina University. Utilizing paraquat to generate endogenous superoxide in *E. coli*.

Both the innate immune system and the three major classes of bactericidal antibiotics utilize reactive oxygen species (ROS) to aid in killing pathogenic bacteria. Inhibition of the enzyme superoxide dismutase (SOD) within bacteria should compromise their ability to defend against antibiotic treatment and immune phagocytes. Like antibiotics, the herbicide paraquat generates superoxide within the cytosol. Two E. coli strains were used for experimentation, a clinical isolate (ATCC 4157) and a lab strain (ER2566). To determine the concentration of paraquat that reduced bacterial growth 50%, a range of concentrations were tested and the growth rate was monitored with absorbance measurements at 600 nm. Time of addition of paraguat following initial inoculation altered the effect paraquat has on culture growth rate, as changes in growth rate were only observed when paraguat was added before the culture entered log phase. Three culture media were tested to determine if their ingredients influence the bacteriostatic effect of paraquat: Luria-Bertani broth (LB), double strength LB (2XLB), and nutrient broth. For ER2566, paraguat had the greatest effect on growth rate in LB and nutrient broth, while no change in growth rate occurred in 2XLB. For ATCC 4157, a decrease in culture growth rate was achieved with a lower concentration of paraguat than required for ER2566 in LB and nutrient broth. When paraguat and SOD inhibitors are used in combination, a reduction in culture growth rate greater then 50% is expected.

P2.3 BENJIE BLAIR. Jacksonville State University. <u>Effect of excess carbohydrate on Clostridium cellulovorans</u> after growth in cellulose.

Understanding regulatory mechanisms in cellulolytic bacteria has taken on new importance in the search for alternatives to fossil fuels. When many cellulolytic anaerobes are grown in consortia like the rumen of an animal they degrade cellulose at very high rates. However, when they are grown in monoculture the rates drop to a fraction of those studied in vivo. An understanding of the regulatory controls could increase the viability of using a renewable resource like cellulose for the industrial production of ethanol or methane as alternatives to oil-based technologies. Other researchers have reported that excess carbohydrate can cause rapid lysis, release of polysaccharides and decreases in the production of ATP in other cellulolytic bacteria such as Fibrobacter succinogenes. The hypothesis of this project was that Clostridium cellulovorans would exhibit similar cell death when exposed to soluble substrates (Glucose, cellobiose, 10 mM) after growth in crystalline cellulose. We have previously demonstrated that cellulosomes, protein complexes involved in cellulose degradation, are lost within 5 minutes of exposure to soluble substrates. After 3 days of growth on ball-milled crystalline cellulose viable cell counts were performed by serial dilution and growth on rumen fluid medium in roll tubes. Viable counts of CFUs did experience a slight drop (10⁷ to 10⁶) after the addition of either soluble substrate and allowed to grow for 24 hours. This decline was much less than previously reported in other organisms.

P2.4 SHAADI F. ELSWAIFI; JOHN SCHWARTZ; AND JAMES R. PALMIERI. Edward Via Virginia College of Osteopathic Medicine. <u>Ehrlichiosis: a case report from Lynchburg, Virginia.</u>

Ehrlichiosis is a tick borne disease caused by an obligate intracellular Gram negative bacterium. In the USA, distribution of human Ehrlichiosis mirrors that of the definitive hosts (white footed mouse, white tail deer) and the distribution of the tick vectors *Amblyomma americanum* (the Lone Star tick), *Dermacentor variabilis* (American dog or wood tick), and *Ixodes persulcatus*. As obligate intracellular parasites of mononuclear cells and granulocytes, Ehrlichia spp. produces cytoplasmic inclusion bodies (morulas) after 5-7 days. Ehrlichiosis refers to infections cause by *Anaplasma* or *Ehrlichia* spp. Ehrlichiosis

produces mild to moderate acute febrile illness. However, in the immunocompromised human host, Ehrlichiosis may be fatal. Serological methods for diagnosis of Ehrlichiosis are often inconclusive; therefore, culturing is required to obtain a definitive diagnosis. Case Report: A 57 year old Caucasian with an active outdoor lifestyle first noticed symptoms three weeks prior to admission. He left work on Tuesday with a severe headache. He remembered removing a dog tick eight days prior. The patient waited a week for the illness to clear. The following Wednesday he went to his internist; blood was drawn and sent to the Mayo Clinic for serological testing. On Saturday he was admitted to the hospital; Lyme Disease and Rocky Mountain Spotted Fever were ruled out. No rash was reported. Temperature fluctuated but never above 99°F. The patient had edema in the extremities. The patient was started on IV fluids and IV Tetracycline to treat what was believed and later confirmed to be Ehrlichiosis.

P2.5 MUHAMMED F. CASIM AND LYNN O. LEWIS. University of Mary Washington. Correlation of chronic diseases with the presence of *T. whipplei* DNA in saliva.

Whipple's disease is a rare systemic infection caused by the bacterium *Tropheryma whipplei*. The disease is mainly known for its symptoms of mal-absorption, diarrhea, and weight loss. However there are also many non-specific symptom, such as polyarthritis, eye movement disorder, and endocarditis, associated with this disease. In this study, we are looking for the presence of *T. whipplei* DNA in saliva (since *T. whipplei* is an intestinal bacterium, but its DNA has been demonstrated in saliva samples), and then we are trying to correlate any symptoms subjects may have with the presence of *T. whipplei* DNA in their saliva. Subjects from a local free clinic as well as UMW students are being asked to provide saliva samples in sterile tubes. DNA is being extracted from approximately 100 saliva samples using a Qiagen DNA MiniPrep kit, and these samples will be used for Polymerase Chain Reaction with known *T. whipplei* primers. The medical history of the subjects is being confidentially recorded and will be used to find any relationships between subject symptoms and presence or absence of *T. whipplei* DNA.

P2.6 PRESTON M SMITH AND PREMILA N ACHAR. Kennesaw State University. Real time PCR to detect and quantify Aflatoxin producing genes in Aspergillus flavus and A. parasiticus in Georgia. Peanuts.

The fungal species Aspergillus flavus and Aspergillus parasiticus are common in Georgia and affect one of the state's major agricultural exports, peanuts. During harvest, storage and transportation A. flavus and A. parasiticus can infect peanuts and produce carcinogenic, mutagenic mycotoxins called aflatoxins. Toxin producing strains may coexist with non-toxin producing strains, and they cannot be differentiated using traditional methods. Using real-time PCR, faster, more accurate results confirming and quantifying the presence of aflatoxigenic and non-aflatoxigenic strains are obtained. In the study, universal primers, (ITS) 1 and (ITS) 4 were used to amplify a conserved portion of the internal transcribed space for non-toxin producing sequences. In addition, two sets of specific primers, Nor 1 & 2 and Ver 1 & 2, which amplify genes coding for enzymes necessary in aflatoxin biosynthesis, were used to identify toxin producing sequences. The Roche LightCycler 480 and SYBR Green were used in the protocol. The results of the relative quantification supported the prediction that a greater concentration of housekeeping genes would be present compared to the genes allowing aflatoxin biosynthesis. In all samples tested, the ITS gene concentration was a factor of 181 and 1,024 times more than the Nor and Ver genes amplified, respectively. The products of the QPCR reaction were run on gel electrophoresis. Our results showed the ability of QPCR to quickly and accurately detect the presence of toxin and non-toxin producing genes in Aspergillus species. Further our results indicated that QPCR is faster and more accurate than traditional methods and PCR.

P2.7 MAŁGORZATA DMITRYJUK AND ELŻBIETA ŁOPIEŃSKA-BIERNAT. University of Warmia and Mazury, Faculty of Biology, Department of Biochemistry, Olsztyn, Poland. The expression of trehalose 6-phosphate synthase gene in *Ascaris suum* tissues.

 α, α -Trehalose serves a variety of functions in the nematodes, i.e. as an energy source, to aid glucose uptake, as a protectant for tissues and embryos during desiccation and freezing stress and to facilitate hatching of eggs. The synthesis of trehalose in nematodes would probably use the two-step pathway. The first step catalysed by TPS (EC 2.4.1.15), which the transfer of glucose from uridine diphosphate (UDP)-glucose to glucose-6phosphate to produce trehalose-6-phosphate. Trehalose synthesis genes have been studied in Caenorhabditis elegans, filarial nematodes and in Aphaelenchus avenae so far. The aim of the present study was to determine the expression of tps1 gene in muscles, haemolymph, the reproductive tract and intestine of Ascaris suum. Tissues of adult female A. suum were isolated and frozen in liquid nitrogen. Total RNA extraction was performed using pegGOLDTriFastTM (PeqLab). Next, RNA was reverse-transcribed into cDNA using the M-MuLV Reverse Transcriptase RNaseH (Vivantis). Expression of tps1 transcript gene was investigated by PCR using primers: 5'-GGGTCTTGGGAGATCAAACA-3' and 5'-TGCTGCTTTGGTGTCAACTC-3'. For gapdh (used as a reference gene) we were using following 5'-CGGTTGTATCGACG-GACTTT-3' the primers: TGAGGCTTTGACGTTCAGTG-3'. The cDNA was amplified with Hot-Start DNA Polymerase (Novazym) at the following PCR conditions: after initial denaturation for 10 min at 94°C, 40 cycles: denaturation for 30 s at 94°C, annealing for 30 s at 55°C and extension for 30 s at 72°C, followed by a final extension for 7 min at 72°C. In conclusion, PCR conditions and primers used were determined; the expression of studied tps1 mRNA in A. suum tissues were observed.

P2.8 GARY J TACKLING, CARRIE B WIESE, AND MARGARET J KOVACH. University of Tennessee at Chattanooga. <u>Microsatellite variability, CGI methylation and differential expression patters in colon cancer.</u>

The overall goal of this study is to investigate the hypothesis that certain genes involved in the molecular pathway(s) of cancer are subject to transcriptional regulation by Microsatellite Instability (MSI). Our hypothesis states that the accumulation of microsatellite variants through defects in mismatch repair and/or normal aging contribute to cancer progression by modifying normal expression of genes essential to cell division. We propose that microsatellites represent a normal, but as of yet uncharacterized, mechanism of gene regulation in which polymorphisms in microsatellite repeats function to control the secondary structure of the genome and mRNA transcripts; structures important in the recruitment and binding of proteins involved in the regulation of transcription. Fourteen colon cancer cell lines were evaluated for MSI, CGI methylation and gene expression of six candidate genes. As predicted, MSI levels were elevated in cell lines defective in mismatch repair. More specific, increased variability was observed for microsatellites observed in the first and middle introns, while, microsatellites located within the last intron and 3'UTR demonstrated minimal tolerance for variability. This sequence conservation suggests a region of functional and/or structural importance. Normal methylation patterns were characterized by hypomethylation of CpG islands overlapping promoters and hypermethylation of CpG islands located internally. Abnormal promoter hypermethylation of the tumor suppressor genes CDKN1B, STK11, and THBS1 was correlated with reduced expression levels in comparison to a normal control. Expression levels for the APC tumor suppressor gene associated with familial adenomatous polyposis were normal for cancer cell lines.

P2.9 TYLER WALKER, TONYA A. CARVER AND MARGARET J. KOVACH. University of Tennessee at Chattanooga. <u>The Effects Of Abnormal PMP22 On Gene Expression Profiles</u>.

Charcot-Marie-Tooth disease (CMT) is an autosomal dominant disorder marked by peripheral neuropathy, resulting from a duplication of the Peripheral Myelin Protein 22 gene. However, there exists a variant (CMT1E) that is uniquely associated with sensorineural deafness. Interestingly, molecular analysis of CMT1E identified a point mutation in the PMP22 gene instead of the usual duplication. PMP22 belongs to the family of Growth Arrest Specific genes, known to regulate gene expression, apoptosis and cellular division across development. PMP22 expression is concentrated in myelinating cells, but its transcript is also minimally detected in non-neural tissues during periods of growth arrest and development. This dual expression is consistent with the description of both neural and cochlear (non-neural) components of hearing loss in CMT1E patients. This study was designed to examine the involvement of PMP22 in cochlear development, where we propose it acts as a transcriptional regulator of genes important to normal ear functions. We hypothesize that a mutation in PMP22 leads to abnormal gene expression patterns, resulting in deafness. The Trembler-J mouse was used as a model for PMP22-related deafness. Differential display was used to characterize gene expression profiles for normal and mutant mice in order to uncover abnormal gene expression patterns associated with the disease. Thus far, 60 genes with abnormal expression patterns have been identified. Of these, 50% are involved in cell regulation, while only 5% are involved in neurogenesis. Seven genes of interest from this subset were subjected to RT-PCR in order to quantify their cellular concentrations across development.

P2.10 EVANGELINE DEER AND DWAYNE WISE. Mississippi State University. Distribution of kinetochores after perturbation of microtubules and spindle poles in cells undergoing mitosis without chromosomes.

In order to further understand spontaneous and induced aneuploidy in eukaryotic cells, we have treated Chinese Hamster Ovary (CHO) cells with hydroxyurea and caffeine in order to induce mitosis without DNA replication. Kinetochore distribution was then assayed in daughter cell pairs still connected by a visible midbody. The amount of centromere protein A (CENP-A) fluorescence in each of the two daughter nuclei was measured and used as an indication of the accuracy of kinetochore distribution. CENP-A is an integral structural component of the kinetochore. Also, PLK (polo-like kinase), a mitotic checkpoint protein involved in proper kinetochore orientation, was used to determine whether or not tension across the cell's kinetochores could be sensed in the absence of the sister kinetochore. The drug, monastrol, was used to inhibit centrosome migration and to produce monopolar spindles. The daughter- pair segragation ration was measured after wash- out of monastrol and establishment of spindle bipolarity. Taxol treatment and wash- out were used to perturb microtubule turnover. After application and wash- out of monastrol and taxol, the segregation ratio was obtained by measuring the total pixel intensity of CENP-A fluorescence in each daughter nucleus. The data collected during the investigation showed that chemically perturbed cell division can help to illuminate the mechanisms of kinetochore orientation and distribution at anaphase in these CHO cells, and by extension, in all eukaryotic cells.

P2.11 ADAM HAWKINS AND IRMA SANTORO. Reinhardt College. <u>Is Maize PAN1 a PAK Protein?</u>

Asymmetric stem cell division has been shown to lead to two distinct types of cells: a stem cell via self-renewal, and either a differentiating progenitor or a postmitotic cell. The regulation of this process is mainly achieved by polarization of the stem cell. It has been suggested that upsetting this process induces tumor formation. Recent evidence in *D*.

melanogaster suggests that impaired neuroblast stem cell polarity results in symmetric stem cell divisions, with defects in progenitor differentiation leading to mutant cells that are unable to differentiate and continue to proliferate. Recently, H. Cartwright et al. identified a protein PAN1 that promotes asymmetric cell division in Maize and has been linked to cell polarization and rearrangement during cell division. The purpose of this research was to identify orthologs to PAN1 in mammalian cells by genomics analyses using the bioinformatics tools from the National Center for Biotechnology Information to better understand the regulation of asymmetric cell division. We identified a family of proteins, p21- Activated kinases (PAK) that showed preliminary amino acid similarity to PAN1. PAKs are implicated in cytoskeletal rearrangements and are linked to proliferation and differentiation in mammalian cells. PAK proteins are also overexpressed in several human tumors. PAK also has been shown to regulate vacuole inheritance in *S. cerevisiae* during the process of cell budding. Bioinformatics tools were used to compare amino acid sequences from several structural regions of each protein. These findings will be presented.

P2.12 ROGER SAUTERER AND RHONDA JOHNSON. Jacksonville State University. <u>Extraction procedures for whole amphibian embryos for 2-D gel electrophoresis</u> using IPG strips.

2-D gel electrophoresis is a potentially powerful method for preliminary analysis of the proteome of cells and tissues, however, optimizing procedures for good results can be difficult. The most critical step is thorough extraction and solubilization of the tissue or cells. Standard procedures and extraction buffers were developed for cultured cells. Extraction of whole vertebrate embryos poses challenges tue to the large amounts of extracellular matrix, insoluble material, keratins and digestive tract proteases. We tested several extraction and solubilization procedures on whole, 100 - 500 mg Xenopus laevis embryos and examined the results by SDS-PAGE and 2-D gel electrophoresis using pH 4-7 IPG strips. Embryos were homogenized in the extraction buffers by 10 strokes in a Teflon homogenizer, followed by sonication (8x 30 sec) at medium high setting. Insoluble material was then centrifuged out. The best extractions were obtained by extracting the embryos directly in 3x Laemmli sample buffer, heating in a boiling water bath, followed by precipitatation in 10% TCA in acetone with 0.07% 2-mercaptoethanol and resuspension of the washed pellets in a 2-D sample buffer. This method extracted more high molecular weight proteins than the other methods. Extraction in Bio-Rad Total Protein extraction buffer (7M urea, 2M thiourea and 1% ASB - 14) gave similar results but fewer high-MW proteins. Extractions in widely used 9M urea + 4% CHAPS resulted in relatively poor solubilization, while homogenization directly in TCA-acetone resulted in an insoluble mass.

P2.13 MERIDETH VAN WICK AND DWAYNE WISE. Mississippi State University. Characterization of cell death in Chinese Hamster Ovary (CHO) cells undergoing mitosis without genome replication.

Programmed cell death (apoptosis) is an important part of eukaryotic cell behavior and plays a critical role in organogenesis and other aspects of development. When CHO cells are treated with hydroxyurea in order to inhibit DNA synthesis and are then treated with the methylxanthine, caffeine, and a "suicidal" death results. Whether or not this cell death is brought about through the apoptosis mechanism is an open question. Possible answers to this question could lead to new understanding of organogenesis, cancer biology and other important biological processes. We have tested for apoptosis in these cells by staining for both caspases, enzymes involved in the breakdown of cellular components, and for and the histone, H2B, which is specifically produced during this process. Using these markers, and double- staining the cells with anti-tubulin antibodies to observe microtubules and with DAPI in order to visualize DNA, we have been able to score the

number of cells in apoptosis from a group of untreated CHO cells in both asynchronous and in synchronized populations. The data have been analyzed for significant differences in the amount of apoptosis in untreated and in MUG cells.

P2.14 CHUNYU DUAN, GINA M. TONG, FENG-RU ZHAO, AND DAVID M. HOLLIS. Furman University. <u>Isolation of an actin-related protein 2/3 (Arp2/3) complex 1(Illike subunit (ARPC1) in the adult teleost fish brain in response to injury.</u>

Unlike adult mammals, the central nervous system (CNS) of adult teleost fish has substantial capacity for neuronal repair in response to injury; however, little is known about the molecular events governing this response. Using differential display, we began examining differential gene expression in the brain of adult rainbow trout (Oncorhynchus mykiss) in response to injury. A surgically applied mechanical lesion was focused on a single side of the midbrain. At 24 hours post-lesion, profound up-regulation of a ~250 base pair fragment was observed in both sides of the midbrain. This fragment was nearly undetectable in the midbrain of all sham- and non-surgery controls. Sequence analysis revealed the fragment as a putative trout homolog to the vertebrate actin-related protein 2/3 (Arp2/3) complex 1(11) subunit, or ARPC1(11). In mammals, the Arp2/3 complex is composed of seven subunits, including ARPC1, which mediates interaction between the Arp2/3 complex and protein activators leading to actin nucleation. These results show, not only for the first time, the presence of a putative ARPC1(1)-like subunit in rainbow trout, but also that ARPC1(1) has a role in the response of the adult teleost CNS to injury. Based on the brain repair and regenerative capabilities of adult fish, these results may indicate a function for the Arp2/3 complex in these processes.

P2.15 VALARIE BURNETT. University of South Carolina-Union, University of South Carolina School of Medicine. <u>An immunohistochemical study of interneurons in</u> rat perirhinal cortex and the effects of Li-pilocarpine-induced status epilepticus.

Perirhinal cortex (PR) is a critical component in recognition memory and temporal lobe epilepsy (TLE), but little is known about its cell types or their vulnerability in TLE. Three distinct interneuronal subpopulations, calretinin (CR+), parvalbumin (PV+), somatostatin (SOM+)-positive cells, were observed in several cortical areas, and most of these cells expressed the inhibitory neurotransmitter GABA. Models of TLE showed selective loss of inhibitory interneurons in several brain regions. Thus, the present study analyzed the distribution and colocalization of CR+, PV+, and SOM+ cells in rat PR, their co-expression with GABA, and changes in a lithium-pilocarpine model of TLE. The largest percentage of CR+ cells (39%) occurred in cortical layer (L) 2. PV+ cells (49%) and SOM+ cells (46%) were highest in L5, but absent in L1. These three cell types did not colocalize, indicating they are distinct subpopulations; however, they demonstrated colocalization with GABA. These results were consistent with other cortical regions. In additional experiments, Li-pilocarpine was used to induce status epilepticus (SE). Significant cell loss occurred in rats 6 days post-SE compared to saline-treated rats. Depending on the level, area, and lamina, the observed cell loss was 48-74% for CR, 28-70% for PV, 32-62% for SOM, and 27-63% for GABA. These results suggest significant changes occurred in the inhibitory system of PR following SE, which may promote hyperexcitability.

P2.16 MADELEINE CHALFANT AND KAREN BERND. Davidson College. <u>17-beta</u> estradiol administration timing alters lung cell response to ozone exposure.

Ozone exposure in the lungs causes lipid and protein peroxidation and increases reactive oxidative species (ROS), altering the balance between ROS and antioxidants in the cell. Cells can upregulate the production of antioxidants, such as glutathione (GSH), to reduce oxidative stress. Estrogen (E2), known for its role in the development of female sex

characteristics, is also an antioxidant and may be involved in the regulation of additional cellular processes, ranging from oxidant-antioxidant balance, inflammation, progression through the cell cycle, and apoptosis. Cells were treated +/- 10nM E2 for 48 hours prior to gas exposure (1 hour , +/- 300 ppb O3, +/- 10nM E2) and allowed to recover for either .5 hour or 24 hours +/- E2 to determine direct vs gene expression effects in the oxidative stress response. Cells treated with E2 before exposure showed decreased levels of GSH after .5 hour recovery but increased levels of E2 after 24 hour recovery. Conversely, both cells treated with E2 during the exposure and after the exposure showed increased levels of GSH .5 hour later, yet showed decreased levels of GSH 24 hours post exposure. These results suggest that the effect of E2 is complex and related to the time of its administration relative to the time of the oxidative stress event. Further research elucidating the effect of E2 and O3 on cellular viability, mitochondrial function, and inflammation as well will extend these results.

P2.17 JESSICA ANDERSON, STEVEN LLOYD AND RYAN SHANKS. North Georgia College & State University. Methamphetamine directly affects the BV-2 murine microglia cell line.

Methamphetamine (METH) abuse causes damage to dopamine (DA) nerve endings activating microglia, the dominant immune cells in the brain. Microglia are innate macrophage cells, which recognize and phagocytose cellular debris caused by neuronal damage. Microglia also initiate changes in the expression of inflammatory signaling molecules. Dysregulation of these microglia inflammatory responses leads to enhanced neuronal damage. Although this has been well documented in response to DAergic nerve terminal damage, it is not clear whether METH has a direct effect on microglia. We modeled the *in vivo* microglia response to METH using a murine microglia cell line (BV-2), which mimics the *in vivo* microglia functional activity and mRNA expression profile. Our data demonstrate direct, dose-dependent effects of METH on microglia within a physiologically relevant range. This response was also measured in a model system mimicking the *in vivo* environment with regard to cellular damage. METH directly inhibits microglia phagocytosis, but this response was attenuated in the presence of cellular debris. We are currently investigating the mRNA expression changes within these model systems.

P2.18 BEAU CORKILL, RICK ROBERTS, EZRA BORTNER, TREVOR MOTT, STEVEN LLOYD AND RYAN SHANKS. North Georgia College & State University. Methamphetamine-induced changes in reactive microglia in the ventromedial hypothalamus.

Methamphetamine (METH) induces excessive dopamine (DA) dumping leading to cellular damage at nerve terminals. Microglia are innate macrophage cells, which recognize and phagocytose cellular debris caused by neuronal damage. Reactive microglia are easily discerned by their morphological characteristics and their increased number is a hallmark of neuronal toxicity. In response to METH, microglia reactivity occurs in the predominant DAergic pathways. However, it is not clear whether METH-induce neurotoxicity also occurs in the Tuberoinfundibular pathway (TI). The DAergic TI pathway originates in the arcuate nucleus of the hypothalamus and projects to the median eminence. DA from the TI inhibits the release of prolactin in the pituitary gland, which has numerous downstream effects. We have observed METH-induced alterations in testicular morphology and serum hormone levels, phenomena associated with dysregulation of TI-regulated prolactin levels. We predict that METH will change the number of reactive microglia in the ventromedial hypothalamus. C57BI/6J mice were given daily i.p. injections of METH (5mg/kg) or saline for 10 days. The brains were collected and processed for histological identification of microglia using biotinylated lectin (a microglia marker). Image analysis will provide standardize counts of activated microglia based on established criteria.

P2.19 RYAN HARRIS, STEPHANIE SONGER, STEVEN LLOYD AND RYAN SHANKS. North Georgia College & State University. The effect of methamphetamine on the spleen in C57Bl/6J mice.

Methamphetamine (METH) is an addictive psychostimulant drug that is abused worldwide. Although METH is a potent indirect agonist of several catecholamines in the nervous system, it also directly and indirectly affects other tissues and organs including the spleen. We observed splenomegaly concomminant with abnormal splenic pigmentation in adult C57BI/6J mice after a 10-day treatment with METH (5mg/kg). Although previous studies have linked spleen pigmentation in young C57BL mice with melanocytes, this phenomenon is absent in adults. In addition, we failed to detect similar pigmentation abnormalities in age-matched control mice. Given the role of the spleen in filtering red blood cells, we hypothesized that the observed METH-induced pigmentation results from macrophage sequestration of excessive blood breakdown products. We employed histochemical techniques to identify the source of this splenic pigmentation and general splenic morphology. We observed hemosiderin deposits in the red pulp of spleens taken from METH-treated mice, which were not present in control animals. We also observed increases in splenic red pulp from METH-treated animals. Furthermore, mRNA analyses of white pulp splenocytes demonstrate significant decreases in inflammatory signaling.

P2.20 STACIA WOOD, JOHN WORKMAN, IRENE KOKKALA, STEVEN LLOYD AND RYAN SHANKS. North Georgia College & State University. <u>The effects of methamphetamine on the reproductive system of male C57Bl/6J mice.</u>

In 2005, the National Drug Intelligence Center reported methamphetamine (METH) abuse to be higher than heroin, with specific detrimental trends targeting the adult male population. We have observed changes in gonad morphology as well as behavioral changes in male mice treated with METH over 10 days, which could be driven by neuroendocrine dysregulation. Oxidative damage in the brain, caused by METH-induced dopamine dumping, effects neuroendocrine functioning. For example, alterations in gonadotropin release from the pituitary regulate testosterone production in the testes. Testosterone is known to affect behavior as well as the structure and function of the testes. Therefore, we predicted that METH exposure would increase gonadotrophin release from the anterior pituitary leading to increases in testosterone. C57Bl/6J mice were injected with METH (5mg/kg) or saline for 10 days. The reproductive tracts from both treatment groups were collected for histological analysis. Testes were collect for mRNA expression analysis and serum was collected for steroid hormone analysis. We identified METH-induced increases in the level of serum testosterone using an immunoassay. PCR analysis of mRNA expression in the testes further supports an increase in steroidogenesis as well as spermatogenesis after METH treatment. Histological analyses of the reproductive tract will provide further information about possible cellular alterations underlying these changes.

P2.21 MADELINE COLTHARP¹, BRITTANY SIMPSON¹, ABIR EL-ALFY², LAINY B. DAY¹. University of Mississippi Biology Department¹. University of Mississippi Pharmacology Department². <u>Schizandrin effects on mice treated with Scopolamine in the Morris water maze</u>.

The cholinergic system, damaged in Alzheimer's, is important in memory. Previous research using rats showed that the natural product, Schizandrin, reverses spatial memory impairments caused by Scopolamine, a centrally acting muscarinic anticholinergic. In this experiment, we tested the effects of Schizandrin and Scopolamine on spatial memory in Swiss Webster mice in the Morris water maze. The mice were fed 10mg/kg Schizandrin or water and injected intraperitoneally with Scopolamine (3mg/kg) or

forming four groups: Schizandrin+Scopolamine. saline Schizandrin+Saline, Scopolamine+Water, Saline+Water(Controls). Mice were trained to locate a submerged platform in the water maze for seven days. On the last day of training mice were given two "probe" trials: a no platform probe and a visible platform probe to examine search for the platform in the previously correct quadrant and non-spatial platform learning, respectively. Unexpectedly, the Scopolamine+Schizandrin group took longer and traveled farther to reach the platform than controls or those givenScopolamine. No other groups differed. In the no platform probe the Scopolamine+Schizandrin group spent less time in the previously correct quadrant than controls, no other groups differed. All groups swimming speed was similar during hidden platform training suggesting motor functions were intact. Interestingly, the Schizandrin group swam less distance to reach the visual platform than the Scopolamine and Scopolamine+Schizandrin group suggesting Schizndrin might improve non-spatial learning. The deficit in the combined drug group suggest further tested is needed before Schizandrin is touted as a cholinergic enhancer.

P2.22 CORINA OLTEAN, HILLARY DOYLE, STEPHEN JETT, KAYLA FANN, BRENNA FINLAYSON, HEATHER IVESTER, CHUCK ROBERTSON, STEVEN LLOYD AND RYAN SHANKS. North Georgia College & State University. The effects of prenatal methamphetamine exposure on executive functions in adult C57BI/6J mice.

Methamphetamine (METH) is a commonly abused psychostimulant with unknown teratogenic potential. As a result of its addictive properties, METH abuse may continue during pregnancy, resulting in neonatal exposure. We predict that prenatal METH will alter frontal brain development resulting in deficits in executive functions in adulthood. To model prenatal exposure, C57BL/6J mice have been injected with saline or METH (5mg/kg) from embryonic day 8.5 until birth. Executive functions (such as working memory, attention and impulsivity) are currently being measured using a five-choice serial reaction time task (5CSRTT) operant paradigm in adulthood (3-4months of age). This paradigm uses a 5-hole operant chamber and an established training protocol based on positive reinforcement and positive punishment. The animal is tasked with performing a specific, discriminative response to a visual stimulus presented at various intervals and locations. In addition to quantitative measures of impulsive responses (e.g., premature responses), we are measuring task acquisition based on trails to criteria (correct responses and omissions) between *in utero* saline and METH-treated animals.

P2.23 DAVID RODRIGUEZ AND JOSE BARBOSA. University of Tennessee at Chattanooga. Expression and Purification of Arabidopsis and Yeast gamma-Aminobutyrate transaminase (GABA-T). Challenges of Protein Purification Under Native and Denaturing Conditions Using Ni-NTA Resin.

Characterization of protein activities, depending on each case, remains a challenge for plant biologists. Functional proteomics enables protein activities to be studied in vitro using advanced protein expression and purification techniques. γ-Aminobutyrate transaminase (GABA-T) catalyzes the breakdown of GABA to succinic semialdehyde. In this study the full length cDNA of an *Arabidopsis thaliana* (*L.*) Heynh GABA-T (GenBank accession no. AF351125) and the yeast ortholog, UGA1 (YGR019w), were cloned into pET-23a expression vector that includes a His₆ tag on the C-terminus. Both yeast and *Arabidopsis* cDNA were successfully expressed in *E. coli* BL-21(DE3) Rosetta carrying the pRARE vector. Extraction and purification of recombinant GABA-T was performed under native and under denaturing conditions and purified on Ni-NTA resin. In spite of high level expression of *Arabidopsis* GABA-T, purification of extracted protein on Ni-NTA resin was only possible under the denaturing conditions. No protein binding to Ni-NTA was observed under native conditions, which suggests that, in this case, the His₆ tag is hidden within the

core of protein. This possibility will be discussed in this study, since the *Arabidopsis* GABA-T has been purified under native condition with His₆ tag at the N-terminus.

P2.24 JANE HARTUNG AND VICTORIA TURGEON. Furman University. Understanding the secondary messenger pathway involved in PAR-1 activated apoptosis of motor neurons in developing chick embryos.

The G-protein linked, protease activated receptor-1 (PAR-1) located on the plasma membrane of spinal motor neurons in developing embryos has been linked to apoptosis necessary for proper development of the central nervous system and to apoptosis associated with neurodegeneration. However, it is not yet known how PAR-1 leads to the activation of the proteins necessary for apoptosis. The purpose of this study was to identify which of the G-protein pathways is triggered following PAR-1 activation. Using spinal motor neurons cultured from chick embryos, the two most common second messengers (cyclic AMP and Ca2+) involved in G-protein pathways were assayed after 24 hrs of PAR-1 activation. Results show that there are no significant changes in intracellular levels of cyclic AMP or Ca2+. While these initial results suggest that neither of these pathways is involved in PAR-1 activated apoptosis, they cannot be completely discounted as PAR-1 activation may require a longer period in culture. Therefore, in addition to investigating additional G-protein linked pathways, motor neurons must also be cultured with the PAR-1 agonist for longer time periods. Understanding the specific G-protein pathway activated in PAR-1 linked apoptosis is an important step to understanding this developmental phenomena and its role in neurodegenerative conditions.

P2.25 LAUREN RICE AND VICTORIA TURGEON. Furman University. <u>Cultured Schwann Cells Express the Protease-Activated Receptor-1 (PAR-1)</u>

Previous studies have shown that activation of protease activated receptor-1 (PAR-1) in the central nervous system leads to a decrease in myelin deposition during development. While the myelinating cells of the central nervous system (CNS) and peripheral nervous system (PNS) are not the same, they produce some of the same myelin proteins. Since both of these cell types have access to the thrombin, the naturally occurring PAR-1 ligand, it is reasonable to suggest that both cell types express PAR-1. While other studies are underway to investigate the distribution of PAR-1 on oligodendrocytes, the myelinating cells in the CNS, the purpose of this study was to investigate the presence of PAR-1 on Schwann cells, the myelinating cell in the PNS. If Schwann cells express functional PAR-1, then treatment of Schwann cells with a PAR-1 activator should result in a change in myelin protein production in comparison to untreated Schwann cells. Western blot analysis of proteins collected from cultured Schwann cells identified the PAR-1 protein. Although activation of PAR-1 on cultured Schwann cells did not result in differential expression of connexin-32, a specific myelin protein, we are currently investigating the effects of PAR-1 activation on other myelin proteins such as myelin basic protein. Whether PAR-1 expression plays a role in myelination or survival of these Schwann cells is not yet known; however, this study will provide the necessary information needed to better understand the role of this receptor in the PNS.

P2.26 SUNDE JONES AND KRISTIN SHIREY. Jacksonville State University. Effects of pH on the Developmental Toxicity of Pine Tree Extract to the Embryos of Xenopus laevis.

Trees that are cut down and turned in to pulp for paper mills can produce chemicals that are harmful to the environment. The normal products of wood include tannins, resin acids, stillbenes, and lignin among other compounds. These compounds are known to affect both humans and aquatic animals. Xenopus laevis embryos were chose because they are a standardize test organism for testing developmental toxicity. The objective is to test the

toxicity of the pine tree extract. Pine tree extract was produced by placing 1 kg of pine tree wood in 10 liters of a standardize water solution called FETAX at room temperature for 90 days. Three liters were stored until use at 4 degrees C . A Standardized Frog Embryo Teratogensis Assay (FETAX) was used to determine the 96 hr LC50, EC50 malformation and Teratogenic Index (TI) of the pine tree extract. Two concentrations were used 5 and 10% v/v to test at a pH of 6.0 and 8.1. Each test concentration had 2 or 4 replicates per concentration with 20 embryos in each dish. Each day dead were recorded and solutions changed. The LC50 was 4.333 and EC50 was 2.291 indicating a TI of 1.89. These results indicate a potential teratogenic risk. The pH 6.0 had significant more mortality, malformation and impact length than the pH 8.1.

P.2.27 TRACY HOOKS AND RICCARDO FIORILLO. The University of Louisiana at Monroe. Helminth community structure of western mosquitofish, *Gambusia* affinis from Bayou DeSiard in Northeast Louisiana.

We sampled mosquitofish, *Gambusia affinis* in Summer and Fall 2009 from several locations along Bayou DeSiard, a 35 mile bayou that meanders through agricultural land, the city of Monroe, and empties into the Ouachita River. Water quality along Bayou DeSiard is impacted by nonpoint source pollutants through storm run off in urban areas and the use of agricultural chemicals in more rural upstream locations. Water quality has been reported to influence fish parasite community structure. At time of submission, we have examined the gastrointestinal tract as well as other visceral organs and body cavity of 98 *G. affinis* for helminth parasites. We have recovered a total of 311 worms representing 11 helminth species (5 trematodes, 4 nematodes, 1 acanthocephalan, and 1 cestode). We'll report data on the seasonal pattern of prevalence, abundance and mean intensity of these helminths, and compare their community structure among various sites in Bayou DeSiard.

P2.28 CHESTER JOYNER, JULI SERGI, AND DANA NAYDUCH. Dept. of Biology, Georgia Southern University. Effect of size, development and location on the prevalence of helminth parasites in Ranid tadpoles collected from isolated bodies of water in Bulloch County, GA.

Ranid larvae inhabit permanent bodies of water, can be very long-lived, and serve as both definitive and intermediate hosts for several helminth parasites. In this study, larvae of Rana catesbeiana (North American Bullfrog) and Rana sphenocephala (Southern Leopard collected from permanent roadside ponds Frog) (n=5) in Bulloch County, GA in May/June and July of 2009 (collection periods 1 and 2, respectively). Tadpoles (n=10-16/site) were measured, staged developmentally, and necropsied to determine helminth parasite prevalence (% infected hosts). Helminths included those that infect tadpoles as definitive hosts (pinworms and trematodes) and/or intermediate hosts (metacercariae). Parasite prevalence was compared between the different collection sites and periods. Parasite prevalence either increased or stayed the same between the first and second collection periods. However, there was a noticeable difference in the types of helminths collected from each site. The temporal and spatial effects on parasite prevalence will be discussed. In addition, we will analyze the relationship between host factors, including both host developmental stage and size, and parasite prevalence. We predict that either larger tadpoles or those with advanced Gosner stages will have higher parasite infection prevalence possibly due to increased feeding and/or exposure to infective stages of parasites. This research can shed light on the helminth parasites inhabiting isolated areas of Bulloch County, and the role that temporal and spatial components, as well as host development, have on parasite burdens in larval anuran hosts.

P2.29 KODY CHASE AND RICCARDO FIORILLO. The University of Louisiana at Monroe. Prevalence and parasitemia of hemogregarines in Colubrid and Viperid snakes from Northeast Louisiana.

Exothermic vertebrates are hosts to a variety of hemoparasites. One group of parasitic protozoans, the hemogregarines (Apicomplexa), have been documented in Louisiana turtles and are the most common hemoparasite found in snakes. Because hemogregarine species may utilize many different vectors (ex. leeches, mosquitoes, ticks), the spatial distribution of snakes within an ecosystem may affect their susceptibility to hemogregarine infection. Snakes that prefer more aquatic or semi-aquatic habitats, may be exposed to a different suite of vectors then more terrestrial or arboreal snakes. Between February and December 2009, we collected 146 individuals representing 12 snake species (41Thamnophis proximus, 38 Nerodia fasciata, 14 Agkistrodon piscivorus, Pantherophis obsoletus, 13 Opheodrys aestivus, 11 Coluber constrictor, 4 N. erythrogaster, 3 A. contortrix, 2 Regina rigida, 2 Farancia abacura, 2 Lampropeltis getula, and 2 Storeria dekayi) from Black Bayou Lake National Wildlife Refuge in Ouachita Parish, Louisiana. These species range in habitat preference from aquatic to arboreal. Preliminary blood analysis shows that O. Aestivus, an arboreal species, was the only snake not infected with hemogregarines. We present data examining the relationship between ecological and life history characteristics of snakes and hemogregarine prevalence and parasitemia.

P2.30 LISA BROWN, NORA SMITH, AND RICCARDO FIORILLO. The University of Louisiana at Monroe. <u>Helminth parasites of the Fowler's Toad, Anaxyrus fowleri,</u> from Northeastern Louisiana.

From September to October 2009, 25 Fowler's toads, *Anaxyrus fowleri*, were collected from a suburban locale near Bayou DeSiard in Ouachita Parish, Louisiana, U.S.A. At the time of this submission, we have examined the gastrointestinal tract and other visceral organs of 18 individuals and recovered a total of 1,912 worms representing 4 helminth species (3 Nematoda, 1 Cestoda). Fifteen (83.3%) of 18 toads were infected with 1 or more helminth species. The helminth component community consisted of 2 nematodes with direct lifecycles, 1 nematode with an indirect lifecycle, and 1 metacestode. Of the total number of worms, we recovered 1,737 nematodes (91%) and 175 cestodes (9%), with infracommunities being dominated by skin-penetrating nematodes. Host size (wet weight) was positively correlated with the abundance of 2 of the 3 nematodes, as well as overall helminth abundance.

P2.31 KATHRYN DOORNBOS, ERICA HENDERSON, SAJAL PATEL, AND ALAN F. SMITH. Department of Biology, Mercer University, Macon, GA 31207. Prevalence and distribution of the causative agent of Rocky Mountain Spotted Fever (*Rickettsia rickettsii*) in field-collected *Dermacentor variabilis* from the Great Smoky Mountain National Park, NC.

Rocky Mountain Spotted Fever (RMSF) poses a significant public health threat with the highest rates of incidence occurring in North Carolina. For the present study, tick collection was conducted during the 2009 summer season in the southeastern section of the Great Smoky Mountains National Park, predominantly within the Deep Creek area. A total of 312 Dermacentor variabilis were drag-cloth collected, individually preserved in 70% isopropanol at 20°C, and GPS coordinates were recorded. No other tick species were collected. Ticks were processed in sequence of collection via genomic DNA extraction, PCR amplification of disease-specific fragments, and agarose gel electrophoresis. Primers specific for *Rickettsia rickettsii* were developed based on the 16S rDNA (5'-TGGCTCAGAACGAACGAACGCTATC-3' and 5'-TTTACCGTGGTTGGCTGCCT-3') to generate a 1414 bp amplicon. The primer set

yielded positive results using a *R. rickettsii* genomic DNA template, graciously provided by the Laboratory of Intracellular Parasites, NIAID, NIH. Tick-specific control primers were also developed based upon the hypervariable, second transcribed spacer (ITS2) of the multicopy rDNA (5'-TCGCTCGTTCGTGTCACCGC-3' and 5'-TTCGCCCATTCCGGCACGAC-3') to generate a 671 bp amplicon. The *R. rickettsii* amplicon, sub-cloned into the pDrive Cloning Vector (Qiagen) and confirmed by DNA sequencing, has served as a reliable internal control template. The development of this effective and streamlined RMSF assay for individual ticks is providing information about the prevalence of RMSF in the Great Smoky Mountain National Park. Funding was provided by the Mercer University Biology Department and Friends of the Great Smokies.

P2.32 RODERICK HILLI¹, SAMANTHA LEWIS¹, KIMBERLY BRAXTON², ANNE ZAJAC², DAVID S. LINDSAY², AND ALEXA C. ROSYPAL¹. Johnson C. Smith University, ² Virginia Tech. <u>A survey of Toxoplasma gondii and Trypanosoma cruzi antibodies in dogs from Virginia.</u>

Toxoplasma gondii and Trypanosoma cruzi are zoonotic protozoan parasites that cause disseminated infections in many vertebrate species. The present study determined the seroprevalence of *T. gondii* and *Tr. cruzi* in a population of dogs from Virginia. Serum samples were tested from 90 domestic dogs collected from animal shelters in Virginia. Using an indirect immunofluorescent antibody test, sera were examined at a 1:50 dilution and antibodies to *T. gondii* were found in 19 dogs (21 %). Antibodies to *Tr. cruzi* were determined by qualitative immunochromatographic dipstick assay. One (1%) of the 90 dogs had *Tr. cruzi* antibodies and it was also seropositive for *T. gondii*. Our findings indicate that dogs are frequently exposed to *T. gondii* in Virginia, but that antibodies to *Tr. cruzi* are rare in the same geographic region. The contribution of R.H was supported in part by a mini-grant from the Johnson C. Smith Institute for Applied Research Center for Excellence in Homeland Security.

P2.33 SHANESHA TRIPP¹, CHRISTOPHER KINLAW¹, R.N. SHARMA², D. STONE², J. P. DUBEY³, AND ALEXA ROSYPAL¹. ¹Johnson C. Smith University, ²St. George's University, ³United States Department of Agriculture. <u>Canine leishmaniasis and American trypansosomiasis in Grenada, West Indies: a seroprevalence survey in dogs.</u>

Canine leishmaniasis and American trypanosomiasis (AT) are caused by related hemoflagellated parasites, *Leishmania spp.* and *Trypanosoma cruzi*, which share several common host species. Dogs are reservoirs for human infections with both pathogens. We determined the prevalence of antibodies to *Leishmania spp.* and *T. cruzi* in dogs from Grenada, West Indies. We examined 70 dog sera using the qualitative immunochromatographic dipstick tests (ICT) based on recombinant antigens specific for visceral leishmaniasis and AT. Antibodies to visceralizing *Leishmania* were not detected in Grenadian dogs by ICT. Using the canine dipsticks for AT, antibodies to *T. cruzi* were determined in 3 (0.4%) of the 70 dogs. Results from this study indicate that dogs in Grenada are exposed to *T. cruzi* at a low rate, but not to visceralizing *Leishmania* parasites. The work of S.T. was supported in part the Historically Black Universities and Colleges-Undergraduate Program (HBCU-UP) at Johnson C. Smith University.

P2.34 MICHAEL J. YABSLEY¹, ELLIS C. GREINER², FLORINA S. TSENG³, MICHAEL M. GARNER⁴, ROBERT W. NORDHAUSEN⁵, MICHAEL H. ZICCARDI⁶, DORI L. BORJESSON⁷, AND SHANON ZOBOLOTZKY⁷. ¹D.B. Warnell School of Forestry and Natural Resources and Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, Georgia 30602; ²Department of Infectious Diseases and Pathology, College of Veterinary Medicine, University of Florida,

Gainesville, Florida 32610; ³Tufts Cummings School of Veterinary Medicine, North Grafton, Massachusetts 01536; ⁴Northwest ZooPath, 654 West Main, Monroe, Washington 98296; ⁵Electron Microscopy Laboratory, California Animal Heath and Food Safety Laboratory, Davis, California 95616; ⁶Wildlife Health Center, School of Veterinary Medicine, University of California, Davis, California 95616; ⁷Department of Pathology, Microbiology and Immunology, School of Veterinary Medicine, University of California, Davis, California 95616. <u>Description of novel Babesia species and associated lesions from common murres (Uria aalge) from California.</u>

Despite being common among mammals, there are few descriptions of piroplasms in avian hosts. Currently, there are only 14 valid avian Babesia species described from 14 avian families. In this report, a novel Babesia species is described from 3 common murres (Uria aalge) admitted to rehabilitation centers in California. One murre had a history of emaciation and hyperpnea and the other two were covered in dark oil, but were otherwise normal on initial physical exam. Blood smears from these three birds revealed infection with intraerythrocytic parasites. To characterize the piroplasms, regions of the 18S and 5.8S rRNA genes and the ITS-1 and ITS-2 regions were sequenced. Genetically, this Babesia was most similar to B. poelea with 99.3%, 85.2%, 97.4%, and 89.1% similarity in the 18S rRNA, ITS-1, 5.8S rRNA, and ITS-2 regions, respectively. Histologic lesions were observed in one bird. This is the first report of Babesia sp. from alcid birds (Order Charadriiformes). Only one other Babesia species has been reported from charadriiforms, i.e., B. bennetti in yellow-billed gulls. The murre Babesia, although morphologically similar to B. bennetti, can be differentiated in its possession of smaller, on average, round and amoeboid forms compared with B. bennetti. Furthermore, 18S rRNA gene sequences from these 2 species were considerably different. Genetically, the murre Babesia was most similar to B. poelea, but can be differentiated in having numerous nucleotide substitutions.

P2.35 BRITTANY SIMPSON, BUCK TRAMEL, AND LAINY B. DAY. University of Mississippi. Comparison of Spatial Learning in CD1 and C57BL6 Mice Strains Using the Morris Water Maze

C57BL6 (C57) inbred mice may be excellent learners due to enlargement of a brain region, the hippocampus. However, one study found that CD1 outbred mice were superior to C57s in the Morris Water Maze (MWM), a hippocampally dependent task. The MWM requires use of spatial abilities to locate a submerged platform in a cloudy pool using distal cues. We compared strains in three versions of the MWM. In the traditional MWM, we placed mice in the pool four times a day for five days for a maximum of sixty seconds to find a stationary platform. We then ran a "probe" trial with the platform removed. We recorded latency and distance to the platform, swim velocity, and time in the previous platform quadrant during the probe. In the one trial learning version (OTL), training and measurement were identical except platform location changed daily and the intertrial interval was 30s rather than 20min. We also compared strains' abilities to reach a visible platform. In both the MWM and OTL versions, C57s had shorter latencies and distances to the platform than CD1s even though CD1s swam faster. During no platform probe, the C57s searched the previously correct quadrant more often than the CD1s. The CD1s performed similarly to the C57s with the visible platform, suggesting a deficit in spatial ability, not in motivation or motor ability. We confirm C57s excellent spatial abilities. To our knowledge, this is the first demonstration of C57s superiority to CD1 mice in the OTL tasks.

P2.36 CASSANDRA LORD AND DARWIN JORGENSEN. Roanoke College. <u>Clearance of the bacterium</u>, *Vibrio campbellii, from the hemolymph* in the American lobster, *Homarus americanus*.

The American lobster, Homarus americanus, is exposed to a multitude of bacterial pathogens in its natural environment. In lobsters, and other decapods crustaceans, hemocytes are mobilized in response to a bacterial infection. Typically, invading bacteria are engulfed by the circulating hemocytes and are "cleared" from the hemolymph. The rate at which lobsters are able to clear bacteria from their hemolymph is currently unknown. Previous research has been done on the rate of clearance of the bacterium, Vibrio campbellii, in Callinectes sapidus, the Atlantic blue crab, and Litopenaeus vannamei, the Pacific white shrimp. The clearance rate in crabs was substantially faster (about 40 min) than that in shrimp (about 240 min). We challenged lobsters by injecting a known of quantity of Vibrio campbellii (5x10e8 cfu - colony forming units) into the heart so that the bacteria would be rapidly distributed throughout the circulatory system. Hemolymph samples were withdrawn at 10 min intervals post-injection and hemocyte and bacterial concentrations were determined. Our data show that bacteria were cleared from the hemolymph in lobsters within 3-4 hr. These results suggest that hemocyte mobilization and the bacterial clearance rate in lobsters are much slower than for blue crabs and closer to that of shrimp.

P2.37 MICAH SPRUILL AND DARWIN JORGENSEN. Roanoke College, Va. <u>Gill hemolymph velocity increases during exercise in the blue crab, Callinectes sapidus.</u>

Blue crabs are commercially-important decapod crustaceans that are capable of migrating substantial distances. Underwater movement in these animals incurs a significant metabolic cost. Blue crabs use gills as respiratory organs. The gills are found in two sets, each set enclosed in a space known as the branchial chamber (BC) located on either side of the thorax. Each BC has a pump (the scaphognathite or scaph) that moves in a cyclical fashion (driven by antagonistic muscles) generating a negative or suction pressure in the BC that ventilates the chamber unidirectionally. The contracting heart pushes hemolymph (blood) through plate-like gill lamellae that are stacked from the base to the apex of a gill. Each lamella encloses hemolymph channels which bring hemolymph into close contact with the ventilatory water. I recorded hemolymph velocity through the afferent vessel of the fourth gill concurrently with hemolymph pressure upstream and downstream from the gill circulation, and hydrostatic pressure in the gill chamber before, during, and after a period of steady-state walking on a submerged treadmill. Our data show a 1.5-2-fold increase in gill hemolymph velocity during exercise that correlated with a 2-fold decrease in BCP (2-fold increased suction). Heart-rate changed by less than 5%. These data indicate that the scaphs may have a substantial influence on gill circulatory function during exercise in these animals.

P2.38 VICTORIA BRINGS AND DARWIN JORGENSEN. Roanoke College. <u>The functional interplay between the gill circulation and the ventilatory apparatus in the lobster: effect of exercise.</u>

Lobsters migrate substantial distances, and their respiratory and circulatory systems work together to support the metabolic requirements associated with this underwater locomotion. Lobster respire using two sets of finger-like gills with an extensive vascular network of small diameter tubes, each set enclosed in a branchial chamber (BC) on either side of the thorax. Each BC is ventilated by a flap-like structure (the scaphognathite) that moves repetitively, generating a suction pressure that pulls water through the BC. A single ventricle contracts rhythmically, pumping hemolymph through the circulatory system that includes the gill hemolymph vessels. My experiments were designed to better understand the interplay between the ventilatory apparatus and the circulatory system in lobsters under conditions of increased metabolic requirement they would experience during migratory activity. I measured hemolymph pressure on both the upstream and

downstream sides of the gill circulation concurrently with hydrostatic pressure in the BC and hemolymph velocity in the afferent vessel of one of the gills before, during, and after a bout of walking on a submerged treadmill. Data from these experiments showed a decrease of about 50% in the pressure drop across the gill circulation (indicating decreased hemolymph flow resistance) correlating with increased scaphognathite activity and resulting decreased BC pressure. Gill hemolymph velocity increased during the exercise period while heart rate remained relatively constant suggesting that increased ventilatory activity may influence gill perfusion.

P2.39 DARLENE PRUITT, RACHEL FAIRHURST, RACHEL LIVINGSTON, ADAM POWELL, and NANCY EUFEMIA DALMAN. North Georgia College & State University, Dahlonega, Ga. <u>Assessing Teratogenic effects of Recycled Tire</u> Mulch Leachates on Frog Embryo Development.

Research has been conducted to test whether leachate prepared from scrap tires has potential human and/or environmental effects but little data has been published determining the effects of tire leachate on the aquatic environment and its inhabitants. Leachate from tires can increase the amounts of heavy metals and organic compounds in aquatic systems. Three FETAX (Frog Embryo Tetratogenesis Assay) tests with Xenopus laevis embryos were conducted using leachates made from tire mulch. The first two studies compared embryo development in leachate produced at 24°C, to simulate typical Georgia springtime weather and leachate made at 40°C to simulate rain runoff during a summer storm. One leachate was made using brown landscape- grade tire mulch while the other was made from black playground - grade mulch. The third study compared leachate made from fresh landscape mulch (non - weathered) versus mulch exposed to environmental conditions for 4 months (weathered). In all studies there were more fatalities and malformations in embryos exposed for 96 hours to the mulch leachates than embryos kept in an isotonic saline solution. Embryos incubated in either landscape or playground mulch leachate made at 40°C showed more serious malformations, such as internal hemorrhage and severely malformed body structure, than the embryos incubated in leachate made at 24°C. Likewise, more fatalities were observed in embryos incubated in the non-weathered tire mulch leachate than embryos incubated in the weathered mulch leachate. Taken together, these results show that tire mulch leachates possess compounds that are teratogenic to Xenopus laevis embryos.

P2.40 LINDSEY MINTON AND JAMES RAYBURN. Jacksonville State University, Biology Department. <u>Preliminary histological evaluation of pine tree extract (from Virginia Pine, Pinus virginiana) on African Clawed Frogs (Xenopus laevis)</u>.

Amphibians are highly reliable environmental indicators, with the genus *Xenopus* being ideal test subjects on a wide variety of environmental problems. Estrogenic compounds are introduced into amphibian habitats through a multitude of mediums, the majority of which are influenced or created through human mechanisms. Some naturally occurring estrogens found in the environment as compounds in some pine trees have been determined to cause estrogenic changes in fish. For our test, we will expose groups of *X. laevis* in tanks to concentrations of pine tree extract (from Virginia Pine, *Pinus virginiana*) from 96hrs after fertilization until metamorphosis, including the stage of gonadal differentiation. Dosages of the pine tree extract will be done on a per weekly basis using test concentrations of differing percentages, and throughout the experiment, the frogs will be kept in tanks with a controlled temperature range of 20-23° Celsius. Effects from this pine tree extract will be determined by time to metamorphosis, malformations, mortality, and histological observations. The study will be focusing on determining the best techniques to observe gonadal mutations and malformations of male and female African Clawed Frogs after metamorphosis. These evaluations will focus on major sites of primary

sexual characteristics, such as the testes and the ovaries, and will be examined using histological slides, staining, and light microscopy.

P2.41 ALYSSA TEAT and JONATHAN HORTON. University of North Carolina at Asheville. A survey of abiotic and physiological characteristics associated with ginsenoside content of *Panax quinquefolius*.

Panax quinquefolius, American ginseng, is an important medicinal plant valued for its production of bioactive compounds, ginsenosides, which exhibit anti-tumorigenic, antiinflammatory, and anti-diabetic properties. Overharvesting of wild-grown ginseng has lead to a loss of genetic variability and population structure which may inhibit its continued use as a medicinal herb. In order to help restore wild populations and standardize commercial harvesting, factors that affect ginsenoside production need to be understood. We monitored environmental and physiological parameters of three native ginseng populations from a protected watershed in western North Carolina and these were related to ginsenoside content. All three sites had similar light environments but differed in soil nutrient availability. Ginsenoside content (driven by changes in Rb1) differed among sites. Maximum photosynthetic rates increased with increasing light availability resulting in greater concentrations of Rd. Ginsenoside concentrations did not vary with age, but overall content increased with age due to increases in root biomass. Stepwise multiple regression was used to relate ginsenoside concentrations with soil nutrient availability. Rb1, Rb2, Rd and total ginsenoside concentrations decreased with increasing soil calcium and manganese. Understanding the abiotic and physiological factors that affect the production of ginsenosides in wild-grown ginseng will help guide the development of cultivation protocols for the developing natural plant product industry in western North Carolina.

P2.42 JANET SCHIBLER AND LINDA NIEDZIELA. Elon University. <u>Cardiovascular and Developmental Toxicity in Danio rerio</u>, <u>Zebrafish</u>.

The compound 2,2',4,4'-tetrabromodiphenyl ether (PBDE 47) is an additive found in plastics to serve as a flame retardant for the products. Recent studies have found traces of the compound in fish, marine mammal, and human tissues, and there is a growing concern that the compound could cause adverse effects. This study used zebrafish as a model organism to investigate the effects of PBDE 47 on the cardiovascular system. Zebrafish embryos were exposed to 5 test concentrations: 100, 500, 1000, 2000, and 5000 g/L from approximately 3 hours post-fertilization until 216 hours post-fertilization. General toxicity was determined by the lethality of the compound, measured daily. Developmental toxicity was assessed by measuring heart rate, and assessing morphological abnormalities daily, then measuring the length of the fish after hatching. An increase in the percent of larvae exposed to PBDE 47 that expressed arrhythmia was statistically significant. When arrhythmia occurred it was almost always in a 2:1 ratio with the atrium contracting twice as frequently as the ventricle. Both chambers exhibited steady rates of contraction, but the atrium displayed a relatively normal rate while the ventricle heart rate was severely decelerated. To determine the mechanism underlying the arrhythmia observed, a specific cardiac gene previously linked to cardiac arrhythmia was targeted and assessed. This gene, zerg, encodes for a potassium channel that greatly contributes to heart rate and rhythm. Gene expression analysis is ongoing as we try to determine if zerg genes are responsible for the arrhythmia seen in this study.

P2.43 GERALD STINSON, JOSH HAMER, AND LAINY DAY. University of Mississippi. Effects of estrogen on recovery of spatial function after cerebellar lesion

The cerebellum is a motor and cognitive planning brain region. Estradiol (E2) promotes neural repair, but E's role in behavioral recovery after cerebellum lesions is unclear. We

used Zebra Finches as models because their cerebellum synthesizes E2 and their brain is more plastic than mammals. We tested the role of E2 in recovery of spatial function. Birds could use visual cues to find an escape hole (2.5cm above floor, 5.5cm diameter) in a clear cylinder (29.8cm H, 30cm diameter) to avoid a hotplate floor (54°C) and rest in an aviary for 1 minute. Escape was assisted after 2 minutes of searching. We recorded latency to escape for 4 trials/day for 7 or 8 days. A final "probe trial" was run with cues turned 180° and a cylinder with no escape. Pecking 180° from the original escape indicates spatial learning. We tested birds with lesions to the medial or lateral cerebellar nuclei and overlying folia. Behavioral trials started 48 hours postlesion. We compared lesioned birds fed systemic Letrozole to block E2 synthesis (20ul/10mg/ml in oil) with lesioned birds fed oil and no-lesion controls fed oil. Birds with E2 synthesis blocked by letrozole were slower to escape than controls, while lesioned birds fed oil recovered spatial ability. To ensure that systemic letrozole effects were on E2 in cerebellum rather than other brain regions; we compared the effects of administering letrozole systemically with administration directly into the lesioned cerebellum. Groups did not differ. Thus, low E2 acting in the cerebellum impairs spatial recovery.

P2.44 CLARE MULREY AND DIANNE BAKER. University of Mary Washington. <u>The effects of atrazine on gene expression of appetite-regulating neurohormones in zebrafish</u>, *Danio rerio*.

Endocrine disrupting compounds (EDCs) are exogenous chemicals that interfere with normal hormonal signaling and regulation. EDCs are released into the environment through the use or production of pharmaceuticals, plastics, pesticides, detergents, and other common products. One endocrine disruptor that is causing increasing concern is atrazine, a commonly used herbicide. Previous studies in a variety of animals have shown that atrazine can impair immune function, reproductive development, metabolism, and appetite. To investigate the mechanism by which atrazine inhibits appetite, we are studying the effect of atrazine exposure on gene expression of the appetite-stimulating neurohormones neuropeptide Y (NPY) and ghrelin in zebrafish. We exposed larval zebrafish to one of two concentrations of atrazine (10 μ g/L or 100 μ g/L) or to control water for 15 days starting at 20 days post-fertilization. We have collected whole head RNA on day 15 of atrazine exposure, and 30 and 60 days after end of atrazine exposure. Levels of NPY and ghrelin mRNA will be measured by quantitative (real-time) PCR. Comparisons will be made across groups to assess acute and long-term developmental effects on the appetite regulatory pathways.

P2.45 BRITTANY CARPENTER AND CLAIRE FULLER. Murray State University. <u>The effect of temperature on immune system function in the Caribbean termite Nasutitermes acajutlae on St. John, US Virgin Islands</u>.

In tropical habitats climate change could have drastic effects on organisms that are accustomed to living at very specific conditions. In particular, small, ectothermic organisms that are dependent on the external environment to regulate most body functions, they may be devastated by even a few degree change in their environment. The goal of this study was to observe immune system function of the Caribbean termite *Nasutitermes acajutlae* when workers from warm and cool colonies are exposed to low and high temperatures (within the normal temperature range for St. John). Termites from ten warm and ten cool colonies were collected and placed in incubators at either 21°C or 27.2°C. Termites were allowed to acclimate for seven days and then immune response was measured. Unmanipulated control termites were also collected from each nest and immune parameters measured the same day. Immune system function was measured using hemocyte counts, cuticular, gut and hemolymph phenol oxidase (PO). Animals that were placed in warm temperatures had significantly lower hemocyte counts than animals in the cool or control treatments (ANOVA, F=4.72, P=0.013, df=2,55). Animals taken from warm nests had marginally lower cuticular PO (F=3.68, P=0.061, df=1, 50). Gut PO was

also lower than controls in warm treatments (F=3.57, P=0.036, df=2, 47). There were no significant differences in hemolymph PO. Therefore, there was a decrease in most immune parameters for animals exposed to warmer temperatures. This suggests that tropical termites may have difficulty with everyday immune challenges as global temperature increase.

P2.46 SARAH A. MAVEETY AND ROBERT A. BROWNE. Wake Forest University. Ground beetle (Coleoptera: Carabidae) diversity as related to elevation in Peruvian cloud forests.

As much as 80 percent of the world's biodiversity occurs in tropical forests. The cloud forests of the eastern Andean slopes of Peru are among the regions of highest biodiversity and endemism in the world and are seriously threatened by land conversion to agriculture and climate change. Understanding such changes in biodiversity requires baseline data. In these forests there are no systemic surveys of beetles (Order: Coleoptera), the most diverse taxon on Earth. Ground beetles (Carabidae) are useful biological indicators because they are highly speciose, have low dispersal due to flightless characteristics, and are relatively easy to collect. No studies have been conducted on the biodiversity of carabids in the highly diverse and imperiled Andean slopes. This study examined carabid species composition for an altitudinal gradient in the Andean cloud forests of Peru. We found a mid-altitude peak in species richness, most likely due to habitat overlap. Seasonality did not appear to affect species number, but did impact species composition. Carabid body length was negatively correlated with altitude, probably due to energetic considerations. Fully winged species were significantly greater at lower altitudes, which we attribute to selection for dispersal ability in the patchy habitat of lowland tropical forests. Our preliminary results indicate that there are profound differences in patterns of carabid species diversity, body length and flight capabilities along a Neotropical altitudinal gradient.

P2.47 BRITTANY DELONG¹, JOSHUA W. CAMPBELL¹ SUSAN LOEB². ¹Shorter College. ² USDA Forest Service. <u>Testing of two Malaise Traps used to Identify</u> Chiropteran (Bats) Insect Diets.

Arthropod diet of bats in the southeastern United States has been primarily based on fecal pellet analysis. Fecal pellets can be misleading, however; because various insects may be more easily digested or pieces of insects may be misidentified. We tested the ability of two malaise traps, one we made from materials bought at a hardware store and a commercial malaise trap. The commercial malaise trap caught a higher overall abundance of insects, yet both traps were similar in the diversity of insects caught. Diptera were primarily caught followed by Lepidoptera. Compared to previous research that examined fecal pellets most orders of insects caught in our traps either highly over-estimated or underestimated.

P2.48 LINDA CANNING AND WILLIAM DEES. McNeese State University. Biometeorological investigations: Response of nocturnally-active mosquitoes to temperature and humidity in southwest Louisiana.

Long-term studies of nocturnally-active mosquitoes in the Sabine National Wildlife Refuge (a salt/brackish/intermediate freshwater marsh) and in Moss Bluff (a freshwater marsh) in Louisiana have been conducted for more than three years and still are underway. These studies involve collecting mosquitoes before, during and after sunset and sunrise, and throughout the night using Centers for Disease Control mosquito light traps. Traps are placed 1.5m above ground in areas with little to no competing light. Meteorological conditions, specifically temperature and humidity, are monitored when mosquitoes are collected. To date, mosquito species have been collected during times of low and high relative humidity (23-95+% RH). Average relative humidity ranged between 71-85%.

Temperature showed greater effect on the distribution of species than humidity. Mosquitoes were collected when average nightly temperatures on a given trap night ranged between 8.8°C and 30.6°C. No mosquitoes were collected when average temperatures were at or below 6.4°C on a given trap night. *Culex* spp. and *Culiseta* spp. were more abundant at lower temperatures (14-21°C) while *Aedes* spp. and *Psorophora* spp. were more prevalent at higher temperatures (22-29°C). Data from this study will broaden our understanding of mosquito flight activity under different meteorological conditions and may provide environmental parameters to better understand the risk of mosquito-borne disease pathogen transmission in southwest Louisiana.

P2.49 A.J. BENNETTAND J.W. CAMPBELL. Shorter College. <u>Terrestrial Invertebrates</u> from Pettyjohns Cave: Does Soil Organic Matter Play a Role?

Pettyjohns cave, located in Walker County, GA, is a popular spelunking site that contains over 6.5 miles of passages. We collected terrestrial invertebrates, with a modified ramppitfall trap, throughout 2009. Surface soil samples from various distance intervals were also gathered to check for total organic matter (TOM). We hypothesized that invertebrate community structure would change over the course of a year due to changing organic matter content. Traps were left out for a period of ten days intervals and soil samples were also taken from each trap location periodically to check for TOM. Diptera was the most common order collected with the majority of them belonging to the family Phoridae. Other common invertebrates collected were Collembolans, Hymenopterans, and Coleopterans . Soil samples that were obtained showed significantly higher TOM near the entrance (5 m) compared to all other distance intervals (75 m, 150 m, 375 m, 600 m).

P2.50 VANESSA CAREY AND JOSHUA W. CAMPBELL. <u>Macroinvertebrate Survey of Byers Cave</u>, Georgia.

Macroinvertebrate biodiversity is poorly known from the majority of cave systems. Cave ecosystems were once thought to harbor only a few specialized species, however, studies have now shown that these ecosystems can be inhabited by a diverse invertebrate community. Byers cave, located on Fox Mountain in Dade county, GA, has 5.5 miles of known passages. Georgia is a cave rich state and effort should be made to inventory the numerous cave invertebrates. Between 2008-2009 we used a ramp pitfall trap and visual searches to accomplish a biological inventory of Byers cave. Numerous arachnids, insects, and other invertebrates were captured. Several of these species are considered troglobites, making them unique species.

P2.51 WILLIAM DEES¹, LINDA CANNING¹, BENJAMIN CLARK¹, ERIN VRZAL², JULIE MCCLURG², CATHERINE ZETTEL NALEN², LEE COHNSTAEDT² AND SANDRA ALLAN². McNeese State University¹, USDA/ARS Center for Medical, Agricultural and Veterinary Entomology². <u>Undergraduate research in mosquito biology</u>.

Biological investigations engage undergraduate students in both field and laboratory research. Entomological research, in particular, offers undergraduates the opportunity to work with living organisms without having to submit animal use protocols commonly encountered in studies using vertebrates and larger invertebrates. Entomological research also enables students to conduct biological investigations on a limited budget while at the same time adding to scientific understanding of important organisms. One area of entomology – medical entomology – provides students the opportunity to work on medically important organisms from both an ecological and medical perspective. Very few organisms, besides the study of disease pathogens themselves, provide students an insight into the complexity of diseases and disease ecology. Studies using medically important arthropods help students understand basic biological and ecological concepts,

while at the same time broadening students' understanding of pathogen transmission and disease ecology. This presentation provides examples of several inexpensive laboratory and field techniques/experiments for students engaged in undergraduate research using mosquitoes and other medically important arthropods.

P2.52 WILLIAM DEES¹, GEORGE SCHULTZ², RICHARD ROBBINS², DAVID HILL² AND BENJAMIN CLARK¹. McNeese State University¹, Armed Forces Pest Management Board². Mosquito identification tools for entomology and health science courses.

Computer-based teaching programs on larval and adult mosquito morphology and identification have been developed to complement laboratory education and training in entomology, pest management, and public health and other health science courses. These programs aid in the identification of larval and adult mosquitoes to the species level. The programs contain (1) tutorials in mosquito morphology, (2) student identification practices, (3) glossaries of mosquito morphology, (4) either larval mosquito chaetotaxy diagrams or adult mosquito drawings, and (5) program maps to aid users in moving about each tutorial. In the larval mosquito program, 29 mosquito genera and over 800 PDFs of chaetotaxy diagrams are presented. Common mosquito genera include (with number of chaetotaxy diagrams): Aedes (254), Anopheles (97), Coquillettidia (4), Culex (195), Culiseta (5), Haemagogus (23), Mansonia (2), Psorophora (7), Toxorhynchites (9), Uranotaenia (48), and Wyeomyia (13). In the adult mosquito program, 28 mosquito genera and over 600 PDFs of adult mosquito drawings are presented. Common mosquito general include (with number of mosquito drawings): Aedes (184), Anopheles (63), Coquillettidia (4), Culex (76), Culiseta (11), Haemagogus (3), Mansonia (3), Psorophora (12), Toxorhynchites (4), Uranotaenia (11), and Wyeomyia (4). A calculator and plastic ruler are recommended when using these programs. A soundcard and Adobe Acrobat™ are required to operate these programs.

P2.53 ANA M. LYONS¹, DIANE R. NELSON², AND PAUL J. BARTELS³.

¹Massachusetts Institute of Technology¹, East Tennessee State University², Warren Wilson College³. The effect of the insecticide imidacloprid on the leaf litter/soil tardigrade community in a hemlock woolly adelgid infested forest in the Great Smoky Mountains National Park, Tennessee.

The hemlock woolly adelgid (HWA) threatens to destroy ecologically important native hemlock forests throughout eastern North America. The systemic insecticide imidacloprid provides several years of resistance to HWA when applied to infested trees by soil drenching. The effects of imicacloprid on soil meiofauna, however, are largely unknown. To determine if imidacloprid affected leaf litter/soil tardigrade populations, a field study was conducted in a highly impacted forest in the Great Smoky Mountains National Park, Tennessee. Two leaf litter/soil samples were collected at the base of each of 20 infested Eastern hemlocks (Tsuga canadensis): 10 trees treated with imidacloprid and 10 left untreated, for a total of 40 samples. Although there were no significant differences between treated and untreated samples in the abundance of tardigrades, rotifers and nematodes, the proportions of mites and "other" arthropods were lower than expected. In total, there were 13 species of tardigrades in all of the untreated samples but only 7 species in treated samples. Chao1 species richness estimate (EstimateS 7.0) indicated that the estimated species richness was lower in the treated samples. This decrease in overall species richness in treated samples may be due to the loss or absence of "rare" species that were present in the untreated samples, low evenness in the samples, and/or patchiness in the populations of some species.

P2.54 JAMIL GHAZAL AND FRANK A. ROMANO. Jacksonville State University. Preliminary results of a multiyear meiofauna survey of the northern Gulf of Mexico with emphasis on tardigrades.

A multiyear, collaborative study of meiofauna (animals less than 1 mm) from the northern Gulf of Mexico benthos is currently underway (a cooperative program with NOAA/NMFS at Pascagoula, MS). Collecting sites are located on both the continental shelf and slope from Brownsville, Texas to the Florida Keys. Bottom substrate samples were collected using a Shipex grab sampler. From this, four 5 x 5 cm diameter PVC pipe cores were removed. Three of these samples were further processed and all meiofauna enumerated. The fourth core sample was saved for granulometric analysis. Animals were fixed in formalin (8% buffered with borax) and processed by sieving followed by centrifugation in Ludox. Processed samples were stored in ethanol (70%) and enumerated under a dissecting microscope. Preliminary data from the 2007 samples include a total of 84,885 total animals of which 12.9% (10980) were nematodes, 0.08% (669) were harpactocopepods. Others found were 25 kinorhynchs, 23 priapulids, 11 tardigrades and 1 loriciferan. Tardigrades found were of several genera: Coronactus, Angursa, Euclavartus, and Styroconyx. Tardigrades were found on the continental shelf off of both Texas and Florida with none being found in the middle portions of the northern Gulf of Mexico. Data from 2008 is currently being finished and will be reported at a later date. We wish to thank Dr. Stephen Landers and his students at Troy University for his laboratory for help with this project and Alonzo Hamilton and G. Walter Ingram at the NOAA/NMFS lab for providing ship time and sample analysis.

P2.55 RACHEL FANCHER AND DEIRDRE GONSALVES-JACKSON. Virginia Wesleyan College. <u>Elucidation of toxins from the nudibranch</u>, <u>Doriopsilla pharpa</u>, from the Chesapeake Bay.

Biological toxins possessing pharmacological properties have been discovered within many species of marine nudibranchs. These toxins display a host of specificities ranging from anti-inflammatory to anti-proliferative characteristics that have the potential to be beneficial in the treatment of a host of diseases. Yet, the toxins of some nudibranchs species, such as *Doriopsilla pharpa*, have yet to be isolated and identified. The objectives of this study were to extract, isolate, and purify the toxins from *Doriopsilla pharpa*, which are believed to harbor scalarane toxins. Several specimens were collected from the Eastern Shore, Virginia and brought back to the Virginia Wesleyan College biology laboratory. The extracted toxins were purified via flash column chromatography and analyzed using infrared spectroscopy to elucidate the chemical structure and classify its potential properties. Additionally, toxins were subjected to biological assays to determine antimicrobial, anti-inflammatory, or anti-cancer properties.

P2.56 ZAC NAPIER¹, DANIEL OSULA¹, WIL GILMORE¹, VICTOR R. TOWNSEND, JR.², DANIEL N. PROUD³, AND PETER A. VAN ZANDT¹. Birmingham-Southern College¹, Virginia Wesleyan College², University of Louisiana at Lafayette³. Costa Rican Harvestmen (Arachnida, Opiliones) Communities: Influences of Microhabitat Use and Rainforest Succession.

There are over 6,000 recognized species of harvestmen worldwide, and there may be an additional 4,000 unidentified species. Species richness for harvestmen is highest in Neotropical rainforests, where 30 or more species may be syntopic. Harvestmen habitat associations are largely determined by humidity and temperature, which may explain why they are so abundant and speciose in tropical rainforests. We conducted a field study at La Selva Biological Station in Costa Rica to compare harvestmen diversity, richness, and total abundance within four different microhabitats (fallen logs, live foliage, tree trunks, and leaf litter) in forests of varying successional stages (young secondary: 8-25 years; old

secondary: 26-34 years; and old growth: >34 years since last harvest). We surveyed 29 plots at night throughout the three forest stages, and in each plot we hand sampled all harvestmen. Overall, we collected 32 species, four of which are undescribed. Harvestmen diversity, richness, and total abundance were strongly influenced by the four different microhabitats. Species richness and diversity were highest in fallen logs and lowest on live foliage. Among the different stand ages, total abundance was highest in the young secondary forests. In contrast to the results for microhabitats, harvestmen communities were similar across the successional gradient. Fifteen species exhibited particularly strong affinities for particular microhabitats or forest stand ages. Our results show that several harvestmen species may be used as indicator species in both microhabitats and forest ages; however, harvestmen appear to be more limited by their microhabitat than by the age of the forest.

P2.57 DANIEL N. PROUD¹, BRUCE E. FELGENHAUER¹, AND VICTOR R. TOWNSEND, JR.². University of Louisiana at Lafayette¹, Virginia Wesleyan College². Intergeneric variation in genital morphology among Neotropical zalmoxid harvestmen (Arachnida, Opiliones) from Central America.

There are nearly 200 species of harvestmen in the family Zalmoxidae, with most taxa (approximately 75%) known from the Neotropical region. In Central America, five genera occur including Ethobunus (24 species), Pachylicus (10 species), Panopiliops (2 species), Phalangoduna (1 species), and Stygnoleptes (3 species). The synapomorphic characters that define the Zalmoxidae are largely based upon genital morphology. In general, the penises of these harvestmen tend to be relatively small and highly modified into complex structures. The main synapomorphic character is the modification of the ventral plate into a pergula and rutrum. Given the significance of genital morphology in defining the family, it is surprising that the genital morphology of most species of zalmoxid harvestmen in Central America have not been described. In this study we used scanning electron microscopy to examine penis morphology for representative species for each of the five known genera for the region. The results of our investigation indicate that there is considerable inter and intrageneric variation in penis morphology among these taxa. Variation is greatest in the shape and position of the pergula, rutrum, and stragulum. Additionally, the number and distribution of setae on these structures is markedly different between taxa.

P2.58 HARRY MEYER AND JULIANA HINTON. McNeese State University. <u>Water bears of the Caribbean.</u>

The first investigations of water bears (Phylum Tardigrada) on Caribbean Islands were made in the mid-Twentieth Century. Since then there have been few studies of terrestrial and freshwater tardigrades in the West Indies. Currently seven papers report the presence of 12 genera and 26 species (including those identified only to genus or species complex) in the West Indies. These studies have been limited to Puerto Rico, Cuba, and Hispaniola (Dominican Republic) in the Greater Antilles and Curação, Los Testigos, and St. Lucia in the Lesser Antilles. Most West Indian tardigrades have been collected from cryptogams. We found five species of terrestrial tardigrade in moss and lichen samples from Barbados, an island of the Lesser Antilles. Four species (Macrobiotus harmsworthi, Macrobiotus hufelandi, Minibiotus intermedius, and Paramacrobiotus richtersi) are cosmopolitan and have been found on other Caribbean islands. One species, belonging to the genus Milnesium, is new to science. This new species is characterized by having a smooth cuticle, a posterior insertion of the stylet supports on the buccal tube, thick main claw branches with very small accessory points, slender secondary claw branches with short basal spurs, and no eyes. The most likely sources of tardigrades on Barbados are colonists from older islands in the Lesser Antilles, or immigrants brought in by humans on introduced plants.

P2.59 BRADY S. CHRISTENSEN¹, TRAVIS J. CROXALL¹, JAY A. YODER¹, DIANA SAMMATARO² AND GLORIA DeGRANDI-HOFFMAN². Wittenberg University¹, USDA-ARS, Carl Hayden Honey Bee Research Center². Spraying fungicides reduces symbiotic microbes necessary for bee bread production.

Honey bee (Apis mellifera) development depends on fungal conversion of stored pollen into bee bread that is fed to larval bees. A combination field-mycological study was done surveying 21 hives in orchards representing various levels of fungicide treatment to determine the amount of fungi present and affected in bee bread. All bee bread samples are characterized by a regular mycoflora profile dominated by Aspergillus spp. and Penicillium spp. and to a lesser extent Cladosporium spp. and Rhizopus spp. Minor components were Alternaria spp., Aureobasidium spp., Bipolaris spp., Colletotrichum spp., Fusarium spp., Mucor spp., Paecilomyces spp., Scopulariopsis spp., Stigmella spp. and Trichoderma spp. (mixed composition), presumably reflective of habitat differences. Bee colonies in direct fungicide spraying resulted in an overall decrease of all fungal components, not a select group or single kind of fungus. This decline correlated with a 3-4 fold suppression in conidia production, 16 hours or 68 hours after spraying. Even if not sprayed with fungicide directly, colonies within 3.2km bee flight range of sprayed areas showed similar reductions in fungal loads as observed in bee bread from directly sprayed areas. Surprisingly, this included colonies from an organic orchard. We conclude that direct and indirect fungicide exposure is disrupting the bee colony fungal community, with implications for death by production of nutritionally-poor food. Beekeepers report increased incidence of chalkbrood disease after fungicide spraying that we now attribute to the pronounced reduction of Aspergillus spp. and Penicillium spp. that are inhibitory toward bee pathogens.

P2.60 BRIAN Z. HEDGES¹, DAVID M. KOLAKOWSKI¹, JAY A. YODER¹, DIANA SAMMATARO² AND GLORIA DeGRANDI-HOFFMAN². Wittenberg University¹, USDA-ARS, Carl Hayden Honey Bee Research Center². <u>Alteration of honey bee (Apis mellifera) colony nutritional source, "bee bread", in response to fungicide exposure.</u>

Symbiotic bee colony fungi convert stored pollen into bee bread, satisfying an absolute dietary requirement for developing bee larvae. When sprayed, fungicides are brought into the colony by bees via contaminated pollen. This study explores effects of fungicide on bee bread fungi in vitro by radial growth rate determination of 12 bee bread fungal isolates with Pristine® (BASF), a broad spectrum fungicide frequently applied to various commercial crops. Natural comb cell conditions were simulated by conducting the experiment on bee-bread supplemented non-nutritive agar, 30°C, darkness, and 5% CO₂. Radial growth rates for each fungus were characteristic and were reduced 12% - 80% by fungicide, depending on species and concentration, in a dose-response. Percentage reduction in growth rates, mortality, and least effective concentration differed among the 12 fungi and did not correlate with whether the fungus was a slow/moderate- or fastgrower; i.e., no two fungi responded the same. Effectiveness of Pristine is species (likely strain)-specific and is not a function of slow growth retaining fungi on treated surfaces longer or decreased exposure times by faster growers that spread rapidly. Most tolerant fungi to Pristine were Rhizopus sp., Mucor sp., and Absidia sp., and Penicillium sp. and Aspergillus niger were the most sensitive. Pristine had a controlling effect on bee fungal pathogens, Ascosphaera apis (chalkbrood) and Aspergillus flavus (stonebrood). Thus, bee bread fungi respond to fungicide differently and could have a negative effect on colony health by altering the composition of mycoflora that bees use to process and store their food.

P2.61 DERRICK J. HEYDINGER¹, MICHAEL R. CONDON¹, JAY A. YODER¹, DIANA SAMMATARO² AND GLORIA DeGRANDI-HOFFMAN². Wittenberg University¹, USDA-ARS, Carl Hayden Honey Bee Research Center². Commercially applied antibiotics are ineffective against honey bee diseases chalkbrood and stonebrood.

Fumagillin (Fumagilin-B®, Medivet), tylosin (Tylan®, Eli Lilly) and oxytetracycline (Terramycin®, Pfizer) are applied to control nosemosis (Nosema apis) and foulbrood (Paenibacillus larvae) in honey bee, Apis mellifera, colonies. The purpose of this study was to explore whether these antibiotics alter the growth of bee breed fungi that convey colony defense (antibiotic producers), provide a source of digestive enzymes in adult bees, and make food for bee larvae from stored pollen as a developmental requirement. Based on fungus culturing, the trisecting line method was used to determine radial growth rates of the 13 most frequently recovered bee fungal isolates, including Ascosphaera apis (agent of chalkbrood disease) and Aspergillus flavus (agent of stonebrood disease), on media treated with antibiotics (1%, 0.1%, 0.01%), alone and in combination. To mimic conditions for making bee bread in a capped wax cell, we measured fungal growth on agar supplemented only with bee bread nutrients at 30°C in darkness and transferred from 5% CO₂ to aerobic conditions. Under these conditions, antibiotic exposure produced no changes in obverse/reverse pigmentation, colony, conidia, philiade characteristics, or initiated production of teleomorphs in any of the 13 fungi. No fungi displayed antibiotic sensitivity, evidenced by lack of dose-response, mortality, antibiotic synergistic effects, and difference from control growth rates. These results suggest that shifts in composition of the bee colony mycoflora are unlikely to occur by use of these antibiotics. Important information for commercial beekeepers is that these tested antibiotics are not effective treatment against stonebrood and chalkbrood.

P2.62 MYLES K. HILL AND STEPHEN C. LANDERS. Troy University, Troy AL. Kinorhyncha, Priapulida, and Loricifera from the northern Gulf of Mexico.

Kinorhynchs, priapulids, and loriciferans are meiofaunal animals found in marine benthos. These microscopic organisms are found in different sediment types, whose role in the ecosystem is relatively unstudied. This presentation reports a portion of a multi-year study of numerous meiofaunal phyla from the Gulf of Mexico. Our collecting sites are located on the continental shelf from southern Texas to southern Florida. Sediment samples were collected with a Shipek grab sampler, with multiple cores obtained from each sample using a 5 cm-diameter PVC pipe. The samples were fixed in formalin and the meiofauna were concentrated using Ludox. Data was collected at both Troy University and Jacksonville State University in this collaborative project. Preliminary data from Troy University for the 2007 and 2008 collections revealed members of the Kinorhyncha, Priapulida, or Loricifera at 29/57 sites. Kinorhynch adults were present at 20 sites and priapulid loricate larvae at 14 sites. Additionally, we recovered one loriciferan adult and one loriciferan Higgins larva at two sites. Sites with no collections of these 3 phyla were evenly distributed across the study area, but the sites with kinorhynchs, priapulids and loriciferans were found mostly east of the Mississippi River. We thank Dr. Frank Romano and his laboratory for help with this collaborative effort. Also, we thank NOAA and the NMFS, SEFSC Mississippi Laboratory for providing ship time and sample collection on the R/V Gordon Gunter.

- P2.63 Canceled
- P2.64 DAYNA COOK¹, CATHRYN WILSON¹, DANIEL N. PROUD², AND VICTOR R. TOWNSEND, JR.¹,. Virginia Wesleyan College¹, University of Louisiana at Lafayette². Comparative study of genital morphology in Neotropical cosmetid harvestmen from Central America and the Caribbean.

In Central America and the Caribbean islands, harvestmen of the family Cosmetidae represent one of the most commonly encountered arthropods in forested habitats. Most taxonomic descriptions of cosmetid harvestmen from this region do not include descriptions of genital morphology (characters that have become standard in more recent taxonomic works). Thus, the taxonomy of these animals is largely based upon the distribution of tubercles on the dorsal scutum and legs, color pattern, and the tarsal formula. In an effort to evaluate the status and systematic relationships of cosmetid genera from this region, we collected and identified several common species from Central America (Panama and Costa Rica) and borrowed over 100 vials of unidentified specimens from the AMNH collection that included specimens collected from a variety of locations including Hispaniola, Nicaragua, Panama, Trinidad, and the Virgin Islands. The penises of select specimens were carefully dissected and examined with light microscopy or scanning electron microscopy. Our results indicate that there is considerable interspecific variation in penis morphology for harvestmen from this region. Structures associated with the penis that represent useful characters include the 1) morphology of the ventral plate; 2) the relative size and shape of the glans and its dorsal process; and 3) the size, shape, and armature of the stylus.

P2.65 VICTOR R. TOWNSEND, JR.¹ AND DANIEL N. PROUD². Virginia Wesleyan College¹, University of Louisiana at Lafayette². <u>Genital morphology of harvestmen (Arachnida, Opiliones) from Trinidad, West Indies.</u>

On the Caribbean island of Trinidad, 30 species (of which at least five are not formally described) of harvestmen (Arachnida, Opiliones) are known to occur in forested habitats including representatives of ten families. Of these taxa, only eight species are known from areas other than Trinidad. The taxonomic descriptions for most of these harvestmen lack detailed descriptions of penis morphology (a significant source of characters that have become standard in modern taxonomic works). In an effort to provide more insight into the morphology and systematic relationships of these harvestmen, we collected adult males of 16 species in the field during the wet season from 2003-2008. For each species, we dissected the penises of multiple individuals (whenever possible) and examined them with light microscopy and scanning electron microscopy. Taxa examined in this study include Cranellus montgomeryi (Manaosbiidae), Cynortula granulata (Cosmetidae), Cynortula undulata (Cosmetidae), Paecilaema inglei (Cosmetidae), Paecilaema paucipustulatum (Cosmetidae), Paecilaema sp. (Cosmetidae), Pellobunus longipalpus (Samoidae), Prionostemma vittatum (Sclerosomatidae), Prionostemma sp. (Sclerosomatidae), Rhopalocranaus albilineatus (Manaosbiidae), Santinezia serratotibialis (Cranaidae), Stygnoplus clavotibialis (Stygnidae), Stygnomma sp. (Stygnommatidae), Trinella leiobuniformis (Agoristenidae), and two species of kimulids.

P2.66 ROBERT WAYNE VAN DEVENDER¹ AND AMY S. VAN DEVENDER². Appalachian State Univeristy¹, 797 Little Laurel Road Extension, Boone, NC². Land Snails of North Carolina. Part 1. Small Species with High Spires. The Carychildae, Cionellidae, Pomatiopsidae, and Pupillidae of North Carolina.

Four families of small to minute land snails have shells that are taller than wide. These families include at least 23 species or about 10% of the taxa currently known from North Carolina, but several additional species are to be expected based on known distributions and recent field work. Most of these species are relatively poorly known because they are often overlooked by collectors and because identification of these snails is difficult. Range of variation in overall shape and apertural armament is incomplete for most species. Identification guides require considerable knowledge of microanatomy and associated jargon. As a result relatively little is known about actual distribution in the state. We provide high quality images made by light microscopy and scanning electron microscopy

of all taxa as well as verbal descriptions which assis in identification of the *Carychium* (4 species), *Cionella* (2 species), *Columella* (1 species), *Gastrocopta* (6 species), Pomatiopsis (1 species), *Pupoides* (1 species), and *Vertigo* (8 species) of North Carolina.

P2.67 DANIEL A. DOUGLAS¹, RONALD S. CALDWELL², AND JOHN E. COPELAND². Eastern Kentucky University¹, Lincoln Memorial University². The Land Mollusca of Norris Dam State Park, Tennessee with notes on Cumberland Plateau and Blue Ridge Affinities.

The distribution of terrestrial gastropods is poorly studied and therefore, ranges of many species are inadequately illustrated in today's literature. In terms of land snails and their composition and diversity, the Ridge and Valley region of East Tennessee is severely understudied. This study examined the biodiversity of the land mollusks of Norris Dam State Park near Norris, Tennessee. Biodiversity was examined in both macro (>5mm) and micro (<5mm) snails. A total of 782 specimens were collected representing 9 families, 23 genera, and 43 species. From this collection, 28 new county records were established for Anderson and Campbell counties, TN. Among these county records, 6 species previously known to occur on the Cumberland Plateau and/or in the Blue Ridge mountains were discovered. The presence of these 6 disjunct populations suggests that the Ridge and Valley physiographic province has been a region of dispersion for some elements of the Cumberland Plateau and Blue Ridge Mountains. This also suggests that the Ridge and Valley of East Tennessee may be serving as a refuge for relictual populations of Cumberland Plateau and Blue Ridge affinities. These findings weaken the belief that the broad Ridge and Valley of eastern Tennessee was a barrier to intermingling between the Cumberland Plateau and Blue Ridge snail fauna.

P2.68 FINK, TOM. East Carolina University. <u>The structure of the empty ornamental nuptial gift of *Empis snoddyi* Steyskal (Diptera, Empididae).</u>

Low vacuum scanning electron microscopy made it possible for the first time to image and describe the morphology of the silk nuptial gift of *Empis snoddyi*. Specimens were collected June 1-2, 2009 in the Pisgah National Forest Campground, across the Blue Ridge Parkway from the Pisgah Inn. The whitish silk gift approximates the shape of an American football and is made of silk "bubblewrap" like irregular polygons. The width of the wall of the gift equals one polygon, or about 168 $\overline{\ }$ m. The entire gift may roughly equal the size of the male in length or it may be much smaller than the length of the male. A large nuptial gift measured 5.12 mm by 3.33 mm.

P2.69 ASHLEY SPANN AND DAVID A. JOHNSON. Samford University, Birmingham, AL. <u>Identification of processed meat source by DNA analysis: A class project</u>.

DNA was isolated from various processed meats (hotdogs, sausage, and souse) and a mitochondrial DNA cytochrome B fragment amplified by PCR. Agarose gel electrophoresis initially confirmed that the primary meat source was as shown on the labels. Amplified fragments were ligated to vectors which were used to transform *E. coli*. Plasmids were isolated and the inserted segment sequenced. Sequence data confirmed the identification of the main meat source. However, one sample appeared to have at least traces of turkey, not shown on the label.

P2.70 JESSICA VAN AUSDALL, KRISTIAN STROOM, MARY GAINES WALKER, AND DAVID A. JOHNSON. Samford University, Birmingham, AL. Molecular genetic investigation of local ciliates (Homewood, AL) and and a search for their endosymbionts.

Ciliates were collected from Homewood, AL area freshwater sources using simple tuna traps. A chelex protocol for DNA isolation from individual ciliates was developed. The presence of ciliate DNA was confirmed by PCR amplification of the mitochondrial cytochrome oxidase gene and agarose gel electrophoresis. Ciliate species were determined by DNA sequencing of the PCR fragment directly or of the cloned fragment. Ciliates were also assayed by PCR for the presence of the Reb gene products found in the *Paramecium* endosymbiont *Caedibacter taeniospiralis*. Since the Reb family of genes has also been reported in soil bacteria, DNA was also isolated from local soil bacteria and Reb primers used to test for the presence of Reb-related genes. Bacteria were identified by 16S rDNA sequencing.

P2.71. LUKE CHIOU, LAURA STULTZ, AND PAMELA HANSON. Birmingham-Southern College. <u>Use of Saccharomyces cerevisiae</u> as a model to determine whether [Ru(phen)₂(qdppz)]²⁺ perturbs topoisomerase function.

Interest in metal based cancer drugs has been fueled by the success of cisplatin as an antitumor agent. Ruthenium complexes have gained recognition for high specificity regarding DNA and fewer side effects than cisplatin. [Ru(phen)₂(qdppz)]²⁺ or Ru(qdppz) shows promise as a anticancer drug in preliminary studies due to the evidence of binding to DNA and topoisomerase I (top I) in vitro. Topoisomerases are crucial enzymes used during DNA synthesis to relieve knots or supercoils in DNA and are usually expressed at high levels in actively proliferating cells such as those found in tumors. This study focused on the ability of Ru(qdppz) to inhibit or poison top I and top II in vivo by using baker's yeast Saccharomyces cerevisiae as the model organism. More specifically, wild type and top II overexpressing strains were used to test the ability of Ru(qdppz) to perturb top II function, while $pdr1\Delta pdr3\Delta$ and $pdr1\Delta pdr3\Delta top1\Delta$ mutants were used to test for top I perturbation. Minimum Inhibition Concentration (MIC) Assays were performed to determine IC₅₀ values for the respective strains in the presence of the known top I poison camptothecin, known top II poison m-AMSA, and Ru(qdppz). As expected, the top II overexpressing strain was much more sensitive to m-AMSA than the control. The average IC₅₀ values for Ru(qdppz) are 7.51μM and 7.83μM for the wild-type and top II overexpressing strains, respectively. Consistent with previous studies, $pdr1\Delta pdr3\Delta topl\Delta$ mutant was more resistant to camptothecin than the $pdr1\Delta$ $pdr3\Delta$ control. The average IC $_{50}$ values for Ru(qdppz) were 3.09 μM and 3.29 μM for $pdr1\Delta pdr3\Delta topl\Delta$ mutant and $pdr1\Delta$ $pdr3\Delta$, respectively. The IC₅₀ values for Ru(qdppz) are not significantly different between the isogenic pairs of strains; thus, Ru(qdppz) does not perturb top I or top II in vivo.

P2.72 YILING CHEN. Old Dominion University. <u>Flash-freezing of nanosecond pulsed</u> melanoma B16: cell morphological and survival analysis.

High electric field is thought to open pores in cell's lipid bilayer but direct morphological evidence is lacking and the exact response of intracellular and plasma membranes are not clear. This research focuses on the use of Flash-Freezing (FF) to capture near-real-time cell membrane changes at the moment of pulse application. Resulted images will be used to document any morphological changes in plasma membranes due to the application of nanosecond pulsed electric field. The cell used in this study is mouse melanoma B16-F10. Immediately after a single electric pulse, cells will be plunged into liquid nitrogen (LN₂) and then freeze substitution for photo micrographic analysis. Such near-real-time freezing protocol along with transmission and scanning electron microscopy (TEM and SEM) analyses provided detailed information on plasma membrane morphological changes. Also the B16 survival/variable assessment will be tested at the different period interval after pulsing.

P2.73 DANIEL COOK AND KAREN BERND. Davidson College. <u>Effect of selenium treatment on alveolar type II lung cells exposed to ozone</u>.

Chronic exposure to ozone, a major component of air pollution, is associated with oxidative damage to lung tissue. Although it is known that ozone is harmful to epithelial lung cells, the exact mechanisms by which lung cells respond to oxidants are not well defined. A recent study however suggests that the reaction of ozone with lung surfactant produces a toxic compound, 1-palmitoyl-2-(9'-oxo-nonanoyl)-glycerophosphocholine (16:0a/9-al-GPCho), by oxidation of the double bonds of unsaturated phospholipids. Selenium is a precursor to selenoenzymes responsible for the production of glutathione (GSH), an important antioxidant. Selenoenzymes may have the ability to inhibit 16:0a/9-al-GPCho production or reduce its toxic effect. This study evaluated the impact of biologically relevant concentrations of selenium in rat alveolar type II cells exposed to unhealthy levels of ozone (300ppb/1hr). Alveolar cells grown with high T3 (high metabolic rate) and treated with low concentrations of selenium post ozone exposure demonstrated greater cell viability and higher GSH levels than cells grown under similar conditions without selenium treatment. Cells grown with high T3 and treated with high levels of selenium also exhibited higher levels of GSH but a decrease in cell viability. While further studies are necessary to fully understand the role of selenoenzymes in alveolar cells, these initial findings suggest selenium's ability to help reduce oxidative damage.

P2.74 JOSHUA HAMER, GERALD STINSON, WILLIAM SOBECKI, AND LAINY B. DAY. The University of Mississippi. <u>Estradiol does not produce coordination</u> improvements after cerebellar lesions.

The cerebellum is a motor cognition and coordination brain region. Estradiol (E2) affects cerebellar brain repair, but whether this translates into recovery of behavioral function after lesions is unclear. We use zebra finches to model E2 effects on recovery as their brains have greater E2 synthesis and plasticity than mammals. We found previously that E₂ improves cognitive recovery after lesions, but not coordination deficits evidenced in the cognitive task. Thus, we examined estradiol's role in recovery of coordination after cerebellar lesions. We developed a "logroll" task that required birds to balance on a free spinning perch inside a Plexiglas box (25cmL x 17cmW x 26cmH) to avoid a hotplate floor (54°C). Birds were placed in the box for 2min/day for 14 days. We compared birds with no lesion to cerebellar lesioned groups that were: a) fed daily letrozole (20ul/10mg/ml) to block E₂ synthesis and given an empty implant, b) fed letrozole and given an E₂ implant to replace blocked E2 synthesis, or c) fed oil and given an empty implant. We used slowed video playback to record attempts to get on the perch, successes, duration on the perch, and tail flicks made while on the perch (compensatory postural movements). Number of attempts, successes per attempts, and duration of successes did not differ between groups. Controls produced fewer tail flicks than the lesioned groups, but hormone treatment had no effect. This confirms that estrogen does not improve motor recovery, implying that there are different cerebellar pathways for cognition and coordination.

P2.75 SHAADI ELSWAIFI AND JAMES PALMIERI. Edward Via Virginia College of Osteopathic Medicine¹. Human <u>Trichinellosis as a public health risk within the European Union: the emerging role of horses in disease transmission.</u>

Trichinellosis is emerging or re-emerging in the European Union (EU). Reservoirs include wild boar, domestic pigs, wolves, rats, meat-eating birds, and horses. Most human trichinellosis is acquired from these animals. Within the EU the number of reported cases started to increase in 2006, indicating reemergence of the disease. From 1975 to 2000 over 3,000 cases of human trichinellosis were reported from consumption of horse meat imported into Italy and France. While considered herbivorous, evidence suggests that horses also eat animals that may host *Trichinella spp.* Feeding horses meats, or waste

products containing meat, occurs in Europe. Furthermore, horses have been experimentally infected from pork products. Conversely, while often thought as a primary source of human infection, < 0.01% of wild boar are found to be infected, suggesting that boar is not a primary source of infection for humans, however, the horse is. *T. pseudospiralis* is a non-encapsulated species responsible for a growing number of infections and is causing increased concern. *T. pseudospiralis* is cosmopolitan and reported from mammalian and avian species. The increase in incidence of trichinellosis caused by *T. pseudospiralis* indicates that *T. pseudospiralis* is an emerging parasite that is contributing to the overall prevalence of trichinellosis in the EU and probably increasing trichinellosis worldwide.

P2.76 JARRED GORDON AND MICHAEL TORRES. Warren Wilson College. <u>Does seaweed (Laminaria and Porphyra) have antibacterial properties?</u>

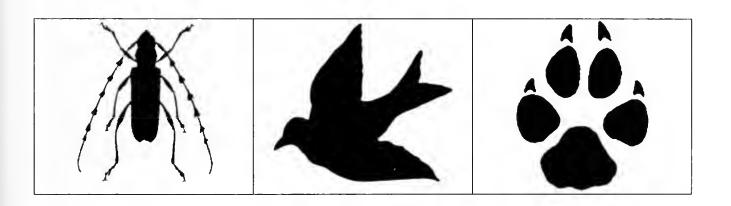
Seaweed has been attributed to have medicinal properties since ancient times. More specifically, Laminaria (a brown macroscopic algae) and Porphyra (a red macroscopic algae) have recently been tested for their anti-bacterial properties. The objective of this experiment was to determine the anti-bacterial properties of these two algae against four different types of bacteria. A methanol extract of each seaweed from the coast of Maine was tested in vitro against bacteria Enterococcus faecalis, Escherichia coli, Klebsiella pneumoniae, and Staphylococcus aureus with the disc diffusion method. A disc of pure methanol and a disc of Streptomycin were used as the controls. These four treatments were replicated ten times. The size of the halo around the disc indicated the efficiency of the antibacterial effects of each extract after an eighteen-hour period. The Laminaria treatments were effective against E. coli, K. pneumoniae, and E. faecalis at the 95% confidence level. The Porphyra treatments were effective against K. pneumonia and E. faecalis at the 95% confidence level. Neither treatment was effective against S. aureus at the 95% confidence level. These results suggest that Laminaria and Porphyra have antibacterial activity against selected (or specific) bacterial species.

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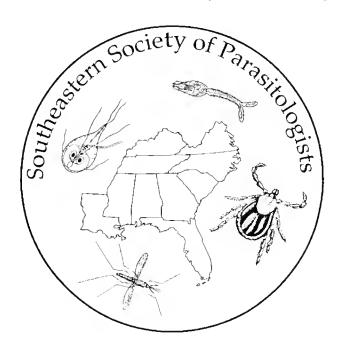
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SSP PROGRAM ABSTRACTS

1. DAVID S. LINDSAY ¹ and GEORGE FLICK² Department of Biomedical Sciences and Pathobiology, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, VA¹, Department of Food Science and Technology, Virginia Tech, Blacksburg, VA². <u>High hydrostatic pressure processing as a means to control zoonotic parasites in food and water.</u>

High hydrostatic pressure processing (HPP) has been shown to be an effective nonthermal means of eliminating non-spore forming bacteria from a variety of food products. The shelf life of the products is extended and the sensory features of the food are not or only minimally affected by HPP. Other advantages of HPP over traditional thermal processing include reduced processing times, minimal heat damage problems, retention of freshness, flavor, texture, and color; no vitamin C loss, no undesirable changes in food during pressure-shift freezing due to reduced crystal size and multiple ice-phase forms, and minimal undesirable functionality alterations. Only recently have parasitologists began examining the effects of HPP on eliminating zoonotic metazoan and protozoon parasites from food. Pressures of greater than 200 MPa (1 MPa = 10 atm = 147 psi) kill Trichinella spiralis larvae in pork and similar pressures will kill larvae of Anisakis simplex in king salmon and arrowtooth flounder. Tissue cysts of Toxoplasma gondii in ground pork are inactivated by exposure to 300 MPa and the infectivity of sporulated *T. gondii* oocysts on raspberries is eliminated by treatment with 340 MPa. The infectivity of oocysts of Cryptosporidium parvum from experimentally exposed oysters for neonatal mice is greatly reduced by treatment with 550 MPa. Treatment of liquids with HPP has been shown to render spores of Encephalitozoon cuniculi and sporulated oocysts of T. gondii noninfective for cell cultures and mice, respectively. The results of these studies on metazoan and protozoon parasites indicate that HPP has the potential to be a useful tool in protecting the food and water supply.

2. SHAADI ELSWAIFI¹ AND JAMES PALMIERI¹. Edward Via Virginia College of Osteopathic Medicine¹. Human <u>Trichinellosis as a public health risk within the European Union: the emerging role of horses in disease transmission.</u>

Trichinellosis is emerging or re-emerging in the European Union (EU). Reservoirs include wild boar, domestic pigs, wolves, rats, meat-eating birds, and horses. Most human trichinellosis is acquired from these animals. Within the EU the number of reported cases started to increase in 2006, indicating reemergence of the disease. From 1975 to 2000 over 3,000 cases of human trichinellosis were reported from consumption of horse meat imported into Italy and France. While considered herbivorous, evidence suggests that horses also eat animals that may host Trichinella spp. Feeding horses meats, or waste products containing meat, occurs in Europe. Furthermore, horses have been experimentally infected from pork products. Conversely, while often thought as a primary source of human infection, < 0.01% of wild boar are found to be infected, suggesting that boar is not a primary source of infection for humans, however, the horse is. T. pseudospiralis is a non-encapsulated species responsible for a growing number of infections and is causing increased concern. T. pseudospiralis is cosmopolitan and reported from mammalian and avian species. The increase in incidence of trichinellosis caused by T. pseudospiralis indicates that T. pseudospiralis is an emerging parasite that is contributing to the overall prevalence of trichinellosis in the EU and probably increasing trichinellosis worldwide.

3. DWIGHT D. BOWMAN¹. Department of Microbiology and Immunology, College of Veterinary Medicine, Cornell University, Ithaca, NY¹. You get what you eat and drink!

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This presentation will cover infection of parasites through the ingestion of parasitic stages. This mode of infection involves the ingestion of parasites either in foodstuffs or water that has been contaminated, through the ingestion of microorganisms that serve as intermediate or paratenic hosts of parasites that contaminate food or water, or in the flesh of other animals that are consumed. Ingestion of contaminated food items with stages passed in the feces of humans probably remains as one of the major sources of human infection. Similarly, the drinking of water that contains stages of parasites passed in the feces of others is also a vbery common form of infection. Sometimes the stages in water are simply resistant parasite stages, but in other cases they represent contaminants by nearly invisible hosts that contain parasites. Finally, because people remain carnivorous and piscivorous, they become infected through the ingested of raw or undercooked prey. Ingestion remains as being most likely the major means by which people are infected by This mode of transmission is often overshadowed by the horrible manifestations of the few important human vector-borne diseases, e.g., malaria, trypanosomiasis, and leishmaniasis, but it still remains the workhorse of parasite transmission.

4. FLAVIA GIRAO¹, ANDREA VARELA-STOKES¹, JEROME GODDARD². Department of Basic Sciences, Mississippi State University¹, Department of Entomology and Plant Pathology, Mississippi State University². <u>Detection of Rickettsia parkeri in the Gulf</u> Coast tick, *Amblyomma maculatum* Koch, in Mississippi.

Amblyomma maculatum Koch is currently reported in most of the southern United States. A. maculatum vectors Rickettsia parkeri, a recently recognized human pathogen. Reports of R. parkeri infection in humans described an eschar at the bite site, fever, fatigue, headaches, muscle pain and generalized rash typically a week after the tick bite. In this study, adult Gulf Coast ticks were collected from nine sites in Mississippi from July to September of 2008 and 2009. The objective was to determine the percent of Gulf Coast ticks carrying R. parkeri in Mississippi. We extracted DNA from the 350 ticks collected in 2008 and 194 in 2009, a total of 544 ticks encountered in Mississippi. Segments of the tick mitochondrial 16S ribosomal RNA gene and rickettsial outer-membrane protein A gene were amplified by separate nested PCR assays. Tick mitochondrial 16S rDNA was successfully amplified in 99.7% (349/350) of tick extracts collected in 2008 and 20.34% (71/349) of extracts were positive for Rickettsia species. DNA has been extracted from ticks collected in 2009 and PCR analysis is currently in progress. Although this tick may carry a rickettsial endosymbiont, the majority of positive samples are suspected to be R. parkeri until sequencing, due to its higher prevalence in these ticks, compared to the endosymbiont. Physicians and health authorities should be aware of R. parkeri and include it in differential diagnosis for a patient presenting the above symptoms. Further study is warranted to better understand the ecology and epidemiology of this vector and R. parkeri.

5. BARBARA C. SHOCK^{1,2}, STACI M. MURPHY¹, LAURA L. PATTON³, PHILIP M. SHOCK⁴, COLLEEN OLFENBUTTEL⁵, JEFF BERINGER⁶, SUZANNE PRANGE⁷, DANIEL M. GROVE⁸, MATT PEEK⁹, JAY BUTFILOSKI¹⁰, DAYMOND W. HUGHES¹¹, MITCH LOCKHART¹², VICTOR F. NETTLES¹, HOLLY M. BROWN², DAVID S. PETERSON², AND MICHAEL J. YABSLEY^{1,2}. Southeastern Cooperative Wildlife Disease Study¹, University of Georgia², Kentucky Department of Fish and Wildlife Resources³, West Virginia Division of Natural Resources⁴, North Carolina Wildlife Resources Commission⁵, Missouri Department of Conservation⁶, Ohio Department of Natural Resources⁷, North Dakota Game and Fish Department⁸, Kansas Department of Wildlife and Parks⁹, South Carolina Department of Natural Resources¹⁰, USDA Wildlife Services¹¹, Valdosta State University¹². Cytauxzoon felis in wild felid populations.

Cytauxzoon felis, a protozoan parasite of wild and domestic felids, is the causative agent of cytauxzoonosis in domestic and some exotic felids. C. felis is known to be transmitted by two ticks, Dermacentor variabilis and Amblyomma americanum, which have overlapping distributions throughout the Southern US; however, D. variabilis ranges further into northern states. Our objective was to determine the distribution and prevalence of C. felis in wild felid populations and to characterize the intraspecific variability. Twelve states were included in the study (Florida, Georgia, Kansas, Kentucky, Louisiana, Missouri, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, and West Virginia). Blood or spleen samples from hunter/trapper-killed felids (n=623) were tested for C. felis by PCR, targeting the ribosomal internal transcribed spacer regions (ITS-1; ITS-2). We detected prevalence rates of 79% in Missouri (39 bobcats [Lynx rufus]), 63% in North Carolina (8 bobcats), 60% in Oklahoma (20 bobcats), 57% in South Carolina (7 bobcats), 55% in Kentucky (74 bobcats), 44% in Florida (45 bobcats), 33% in Louisiana (1 bobcat, 1 cougar [Puma concolor], 1 serval [Leptailurus serval]), and 27% in Kansas (41 bobcats). The prevalences were lower in Georgia (9%, 159 bobcats), North Dakota (2.4%, 124 bobcats, 5 cougars), Ohio (0%, 19 bobcats), and West Virginia (0%, 37 bobcats). We also characterized the ITS-1 and ITS-2 genes and found greater intraspecific variability in wild felids than what has been reported in domestic cats. These data indicate that C. felis is widespread and quite diverse in bobcat populations.

6. ALICE E. HOUK¹, DAVID GOODWIN¹, ANNE M. ZAJAC¹, STEPHEN BARR², AND DAVID S. LINDSAY ¹¹Department of Biomedical Sciences and Pathobiology, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, Virginia, ²Department of Small Animal Clinical Sciences, College of Veterinary Medicine, Cornell University, Ithaca, NY. Prevalence of IgG antibodies to Trypanosoma cruzi, Toxoplasma gondii, and Neospora caninum in opossums (Didelphis vriginiana) from Louisiana.

We examined the prevalence of antibodies to zoonotic protozoan parasites (Trypanosoma cruzi and Toxoplasma gondii) and protozoan's of veterinary importance (Neospora caninum) in a population of opossums (Didelphis vriginiana) from Louisiana. Samples from 30 opossums were collected as part of a hemaculture survey for *T. cruzi* in Louisiana opossums. Frozen sera from these opossums were examined using an indirect immunofluorescent antibody test (IFAT) at the Virginia-Maryland Regional College of Veterinary Medicine (VAMDRCM), Virginia Tech, Blacksburg, VA. Parasite stages used for antigen were grown in vitro in our laboratory. Briefly, epimastigotes of the Brazil strain of T. cruzi were grown in Grace's insect medium supplemented with 30% (V/V) fetal calf serum and antibiotics, tachyzoites of the RH strain of To. gondii and NC-1 strain of N. caninum were grown in human fibroblast cells. Parasite stages were air dried onto wells of Teflon coated IFAT slides and used as antigen. Test opossum sera were incubated with antigens for 30 minutes and the slides washed in phosphate buffered saline (PBS). Next, rabbit anti-opossum sera were incubated with the antigens on IFAT slides for 30 minutes then the slides washed in PBS. Finally, fluorescence labeled goat anti-rabbit sera were incubated with the antigens on IFAT slides for 30 minutes and washed in PBS. Slides were examined using an epifluorescent microscope. The prevalence of reactive IFAT samples were as follows: 60% for T. cruzi, 47% for To. gondiii, and 3% for N. caninum. Hemaculture revealed that 16 (53%) of the 30 samples were positive for T. cruzi compared to 18 of 30 (60%) by IFA. Supported in part by grant 117797 from the Office of Research and Graduate Studies VAMDRCM to DSL.

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7. DAVID G. GOODWIN¹, TERRY HRUBEC^{1,2}, ANNE M. ZAJAC¹, JEANNINE STROBL², BRAD KLEIN¹, AND DAVID S. LINDSAY ^{1 1}Department of Biomedical Sciences and Pathobiology, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, Virginia. ²Edward Via Virginia College of Osteopathic Medicine, Blacksburg Virginia. Evaluation of interferon-gamma treatment of dams on the behavior of their offspring congenitally infected with *Toxoplasma gondii*.

Toxoplasma gondii can cause congenital infection in humans. Approximately 85-90% percent of women in the U.S population are at risk of developing congenital infection. Pregnancy brings about a state of immunosuppression making women more susceptible to infectious agents. Administering immune stimulation to pregnant individuals is a way to negate some of the deleterious effects caused by diseases. Chronic infection with T. gondii has been shown to result in decreased motor function, increased open field activity and decreased memory in mice. Our experiments used immune stimulation of the pregnant dam with interferon-gamma (INF-g) prior to inoculation with T. gondii. Our goal was to examine the role immune stimulation plays in limiting the negative behavioral effects as a result of congenital toxoplasmosis. The Barnes maze test is used to look at spatial memory, rate of learning, memory acquisition, open field activity, and motor function to a minor extent. We used 4 treatment groups; 1) uninfected not given INF-g or T. gondii, 2) immune stimulated with INF-g not given T. gondii, 3) immune stimulated with INF-g and T. gondii infected, and 4) T. gondii infected not given INF-g. The offspring used in the experiment were switched to surrogate dams at birth to negate the effects of toxoplasmosis on the dams. One week after weaning (4 weeks of age), the pups were tested using the Barnes maze test. Different mice from the same litter were tested again at 8 weeks of age using the Barnes maze test. By testing at two age points we aim to gain an understanding of how congenital infections may alter mouse behavior both pre or post sexual maturity, and also determine if maternal immune stimulation can prevent any of the observed behavioral changes.

8. JENNIFER PATONAY AND CHRIS A. HALL. Department of Biology, Berry College, Mount Berry, GA. Evidence for an enhanced infectivity of a Type IIa strain of Trypanosoma cruzi for placental syncytial trophoblast cells.

Trypanosoma cruzi represents a genotypically diverse family of organisms with documented differences in tissue tropism and pathogenicity. Previous breeding experiments comparing the relative abilities of Type I and Type IIa strains of T. cruzi to be congenitally transferred in mice suggests that the Type IIa may have adaptations increasing its rate of transmission through the placenta. In this study we sought to determine whether the Type IIa strain has an enhanced ability to infect BeWo cells, an in vitro model for the placental syncytial trophoblast interface. Cultures of BeWo cells were exposed to North American isolates of either the Type I or Type IIa strains of T. cruzi. At 48, 72, and 96 hours post-exposure cells were fixed, stained, and microscopically assessed for both the percentage of cells infected and average number of intracellular amastigotes. BeWo cultures exposed to the Type IIa isolate had significantly higher percentages of infected cells, as well as a higher average number of intracellular amastigotes, at all time points tested. Control cultures carried out in DH-82 canine macrophages showed that in these cells the two isolates invaded and reproduced similarly, supporting an enhanced tropism of the Type IIa isolate for the placental cells. These results confirm that significant differences exist in the ability of these two isolates to invade and replicate in placental syncytial trophoblast cells. This provides additional support to the hypothesis that the Type IIa strain may possess adaptations to facilitate placental transmission.

9. LORI LOLLIS¹, RICHARD GERHOLD^{1,2}, ELIZABETH LYNN¹, LARRY MCDOUGALD¹, ROBERT BECKSTEAD¹. Poultry Science Department¹, College of Agriculture and Environmental Sciences, University of Georgia, Athens GA. Department of Veterinary Pathology², College of Veterinary Medicine, University of Georgia, Athens GA - Molecular characterization of the ITS-1, 5.8s, and ITS-2 rRNA regions of *Histomonas meleagridis*

Histomonosis, caused by Histomonas meleagridis, is a major disease of gallinaceous birds and causes significant economic losses to the poultry industry. Although it is known that there are differences in virulence and tropism of H. meleagridis, genetic analysis of the parasite has not been conducted to determine if there are genotypic variations responsible for these differences. Histomonas DNA was extracted from paraffin embedded tissues of domestic poultry cases previously diagnosed as histomonosis. The ITS1, 5.8S, and ITS2 rRNA regions were amplified by PCR using the primers ITSF and ITSR and sequenced. Nucleotide sequences of approximately thirty amplicons were compared to each other as well as a single H. meleagridis sequence, and other closely related protozoan sequences available from GenBank. The results of the sequence analysis suggest that there are at least two different genotypes within the H. meleagridis morphologic complex. One group is closely related to the H. meleagridis sequence available from GenBank, while the other group of our sequences has a higher nucleotide identity to Dientamoeba fragilis (70%) than to H. meleagridis (65%) and had at least thirtyeight nucleotide polymorphisms compared to the H. meleagridis sequence from GenBank.

10. MATTHEW S. TUCKER¹, LUCIA GERENA², KATHERINE SORBER³, MICHELLE DIMON³, AZLIYATI AZIZAN¹, ZHINNING WANG², QIN CHENG⁴, JOE DERISI³, AND DENNIS E. KYLE¹. University of South Florida¹, Walter Reed Army Institute of Research², University of California-San Francisco³, Australian Army Malaria Institute⁴. Molecular characterization of resistance to artemisinin drugs in *Plasmodium falciparum*.

Artemisinin (QHS) and its derivatives are effective against all stages of *Plasmodium* spp. and they provide faster clearance of parasitemia than any other drugs. Discontinuous exposure to artelinic acid (AL) or QHS in vitro produced AL and QHS resistant progeny of P. falciparum lines W2, D6, and TM91c235. Using this method, we produced parasites that could tolerate 340ng/ml of QHS (D6), 200ng/ml QHS (W2), and 280ng/ml of AL (TM91c235). After exposing D6 and D6.QHS340 to concentrations of QHS ranging from 28.2-2400ng/ml, we found D6 could tolerate up to 1500ng/ml QHS, and D6.QHS340 tolerated 2400ng/ml QHS. In vitro susceptibility testing with various antimalarial drugs found resistant D6 and W2 lines were less susceptible to some drugs, but not all. In regard to artemisinin drugs, resistant parasites exhibited similar susceptibility as parental strains, with a few exceptions. Prior microarray and real-time PCR performed on drug selected progeny of W2 and TM91c235 identified differentially expressed genes and increases in pfmdr1 copy number and/or expression. We conducted similar analyses and employed other molecular methods to dissect resistance using the most drug selected lines. Whole genome sequencing of D6 and D6.QHS2400 identified single nucleotide polymorphisms (SNPs) that may be involved in resistance as well as a 76 kb amplification event. Proteomic analyses found proteins that may be differentially expressed in D6 vs. D6.QHS2400 and W2 vs. W2.QHS200. Future research will focus on further dissecting whole genome sequence and proteomic data of parental and resistant parasites.

11. RICHARD W. GERHOLD^{1,2}, LORI A. LOLLIS¹, AND LARRY R. MCDOUGALD¹. Department of Poultry Science, The University of Georgia¹, Department of Veterinary Pathology, The University of Georgia² – <u>Immunization of Northern Bobwhites with a low dose of Eimeria lettyae provides protection against a high dose challenge.</u>

To determine if Northern Bobwhite quail (Colinus virginianus) can be immunized against Eimeria lettyae by a low dose inoculation of oocysts, we inoculated sixty birds with either 100 or 1,000 oocysts within the first week of life. Four weeks following the immunization. the immunized birds were challenged with 1 X 10⁶ oocysts of E. lettyae. Eight days following the challenge, birds were killed, weighed, and intestines examined for gross Parameters used to determine effectiveness of the immunization in the immunized challenged quail included percent weight gain, intestinal lesions, severity of diarrhea, feed conversion ratio, and oocysts production compared to the unimmunized unchallenged as well as unimmunized challenged quail. Immunized birds gained an average of 33.3 gm; whereas unimmunized challenged birds gained 11.5 gm. Immunized quail produced 99.7% fewer oocysts, contained minimal gross intestinal lesions, had minimal diarrhea, and had a 50% lower feed conversion ratio compared to unimmunized challenged controls. Our findings indicate that immunization not only aids in suppression of weight loss, but it also leads to the production of significantly fewer oocysts. These findings indicate that vaccination is a viable option for controlling coccidiosis in quail and that research aimed at creating vaccine strains is warranted.

12. ROXANNE A. CHARLES¹, MICHAEL J. YABSLEY^{1,2}, ANGELA E. ELLIS³, ASHLEY M. ROGERS¹, KATHERINE F. SMITH⁴. ¹Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, GA; ²Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA; ³Veterinary Diagnostic Lab, College of Veterinary Medicine, Athens, GA; ⁴Brown University, Providence, RI. A <u>Survey of Parasites of Wild Caught Tokay Geckos (Gekko gecko)</u>, from Java, Indonesia.

In the current study we surveyed 81 wild-caught Tokay Geckos (Gekko gecko) from the island of Java, Indonesia for endo- and ecto-parasites. Based on necropsy and fecal examination, 94% of geckos were infected with at least one parasite, including at least six helminth species, one pentastomid species, and two species of coccidia. No ectoparasites were detected on any gecko. At necropsy, we identified Paradistomum geckonum in the bile duct (prevalence (P)=1.2%, mean infection intensity (MII) = 7.0), Oochoristica sp. in the small intestine (1.2%, 1.0), larval acanthocephalans and nematodes in the coelomic cavity (13.5%, 2.0 and 1.2%, 1 respectively), Physalopteroides sp. in the stomach (11.1%, 2.3), several species of pinworms in the family Pharyngodonidae in the large intestine (54.3%, 29.0), and Raillietiella affinis (40.7%, 8.7) in the lungs. Histological examination of stomachs indicated that at least 4.9% of geckos were infected with Cryptosporidium spp. In addition, an unidentified trematode was observed in the pancreas of two geckos and endogenous stages of Eimeria tokae were detected in the small intestine of numerous animals. At necropsy, a fecal sample was examined for ova and oocysts. We found eggs morphologically consistent with Paradistomum geckonum (P=2.6%), Oochoristica sp. (P=1.3%), Physalopteroides sp. (P=9.2%), pinworms (P=50%), and an unidentified trematode (P=5.3%). Oocysts of E. tokae were found in 67.1% of geckos. These data indicate that wild-caught geckos from Indonesia are infected with several species of parasites, some of which might be zoonotic (e.g., Cryptosporidium).

13. WEATHERLY MEADORS¹, STEPHANIE PALESSE^{1,2}, ALLAN STRAND¹, WILLIAM A. ROUMILLAT³, ISAURE DE BURON¹. ¹Department of Biology, Grice Marine Laboratory, College of Charleston, Charleston 29412, ²Littoral, Environnement et Sociétés, CNRS, Univ. La Rochelle, 17000 La Rochelle, France, ³Marine Resources Research Institute, South Carolina Department of Natural Resources, Charleston SC 29412. Molecular detection of putative paratenic hosts of the southern flounder philometrid species.

The southern flounder, Paralichthys lethostigma, is infected by two species of philometrids, Philometra overstreeti and Philometroides paralichthydis, which are composed of four genetic clades corresponding to their respective habitat in the host: "fin muscles", "buccal bones", "teeth", and "gill arches". Population dynamics data showed that these clades have a different ecology and rarely infect all habitats simultaneously. We hypothesized that individuals belonging to these clades have life cycles that involve different fish paratenic host species reflecting potential sequential infection by the various clades. Polymerase Chain Reaction-Restriction Fragment Length Polymorphism (RFLP-PCR) technique was used to identify species and clades of philometrids. Part of the Cytochrome Oxydase I (COI) gene was amplified with taxon-specific primers. Amplicons were digested with six selected endonucleases, Mse I, Alu I, BsaW I, CviA II, HpyCH4 V and Bda I. Restriction profiles were obtained for each clade of P. overstreeti and P. paralichthydis and for Philometra carolinensis that parasitizes the spotted seatrout, Cynoscion nebulosus, which is sympatric to the southern flounder. Mesenteries of 8 fish species known to be preyed upon by southern flounder and infected with nematode larval stages were analyzed. Out of 228 fish dissected, 32 were infected by nematodes, of which 14 were found to be infected by philometrids using PCR. RFLP analysis showed several results: the presence of the "gill arch" clade in the mesentery of one mummichog, Fundulus heteroclitus and one freshwater goby, Ctenogobius shufeldti, the presence of P. carolinensis in three freshwater gobies, and the presence of 12 unknown profiles in various other fishes. The other three clades ("teeth", "fin muscle", and "buccal bones") were not encountered in any of the fish studied. Although this study demonstrated the usefulness of PRC-RFLP technique to distinguish between philometrids species, the occurrence of several unknown profiles showed its limitation when in the presence of unknown species as is clearly our case. Direct sequencing of a portion of the COI gene is currently being used to differentiate between individuals that could not be positively identified by RFLP.

14. VASHA HSU¹, DAVID C. GRANT², J. P. DUBEY³, ANNE M. ZAJAC¹ AND DAVID S. LINDSAY ¹¹Department of Biomedical Sciences and Pathobiology, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, Virginia, ²Department of Small Animal Clinical Sciences, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, Virginia, ³Animal Parasitic Diseases Laboratory, Agricultural Research Service, United States Department of Agriculture, Animal and Natural Resources Institute, Beltsville, Maryland. <u>Prevalence of IgG antibodies to Sarcocystis neurona in cats from Virginia and Pennsylvania.</u>

Sarcocystis neurona is best known as the causative agent of equine protozoal myeloencephalitis of horses in the Americas. Domestic cats (Felis domesticus) were the first animals described as an intermediate host for S. neurona. Sarcocystis neurona associated encephalitis has been reported in naturally infected cats in the United States. Thus, cats can be implicated in the life cycle of S. neurona as natural intermediate hosts. The present study examined the seroprevalence of IgG antibodies to merozoites of S. neurona in populations of domestic cats from Virginia and Pennsylvania. Overall, sera or plasma from 448 cats (Virginia = 239; Pennsylvania = 209) were tested by an indirect immunofluorescent assay at a 1:50 dilution. Antibodies to S. neurona were found in 32 (7%) of 448 cats. Of which, 22 (9%) of the 239 cats from Virginia and 10 (5%) of the 209 cats from Pennsylvania were positive for antibodies to S. neurona. Because of the low seroprevalence of antibodies to S. neurona in cats, the role of domestic cats as intermediate hosts in perpetuating the life cycle of S. neurona is probably minimal compared to that of other natural intermediate hosts such as raccoons and skunks that have a much higher seroprevalence.

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15. WHITNEY BULLARD, CASEY UNDERHILL, NICOLE ACUFF, AND CHRIS A. HALL. Department of Biology, Berry College, Mount Berry, GA 30149. <u>Development of an in vitro model for the role of complement activation and body temperature in the innate avian resistance to *Trypanosoma cruzi* infection.</u>

Although numerous mammalian species are known to be permissive hosts for T. cruzi, birds possess an innate resistance to infection. Evidence suggests that modifications in the alternative pathway for complement (APC) activation are largely responsible for this protection. The specific mechanisms involved in the activation of the avian APC against T. cruzi are unknown. To facilitate future investigations into these mechanisms we sought to develop a reliable in vitro model for the complement mediated lysis of T. cruzi. To ensure the fidelity of the system, comparisons to the complement systems of both humans and raccoons were also performed. To assess complement function, separate cultures of blood stream form trypomastigotes (cBSF) and epimastigotes (EMs) were exposed to pooled normal or heat inactivated sera from chickens, humans, or raccoons, Cultures were incubated at 25, 37, or 40°C for 1, 60 or 120 minutes and subsequently evaluated by hemocytometer counting for parasite attrition. Results showed that significant numbers of epimastigotes were lysed upon exposure to both normal and heat inactivated serum from humans and chickens, suggesting a complement independent mechanism of lysis against this stage. When cBSF parasites were exposed to the normal and heat inactivated serum of humans and raccoons, little attrition was observed at 25° and 37°C across all the time points measured. Culturing of cBSFs in the presence of normal chicken serum resulted in significant decreases in parasite concentration, with heat inactivation rendering the chicken serum. Interestingly, all cBSF cultures, including serum free controls, showed sharp decreases after 120 minutes of exposure to 40°C. This suggests that physiological body temperature may contribute to the innate resistance in birds.

16. GAIL MORARU¹, JEROME GODDARD², and ANDREA VARELA-STOKES.¹ Department of Basic Sciences, Mississippi State University¹, Department of Entomology and Plant Pathology, Mississippi State University². The role of small animals in the natural history of *Rickettsia parkeri*.

The Gulf Coast tick, Amblyomma maculatum, is the vector of the pathogenic bacterium, Rickettsia parkeri; however, the natural history of R. parkeri in the Gulf Coast tick is poorly understood. In a study of A. maculatum host preference, larvae or nymphs were given a choice of host, among anoles, cotton rats, and quail; we recorded the number of engorged ticks from each host. To evaluate feeding success, we placed ticks directly on each animal and allowed them to feed until engorged. We recorded the number that engorged, successfully molted, and weights of engorged nymphs. To study R. parkeri infection, four quail and four rats were injected with organism; one of each species received uninfected media as a control. We collected blood samples during the study to test for antibodies and rickettsial DNA; we also put larvae and later, nymphs on the animals to evaluate acquisition of organism by ticks. Because the number of recovered ticks was low, no significant difference in host preference between quail and rats could be seen. More engorged ticks were recovered from quail in the feeding success study, but those from rats weighed significantly more. We found no ticks that fed successfully on anoles, thus, anoles were not used in the infection study. Both quail and rats exposed to R. parkeri seroconverted by day post-infection 11, but none became rickettsemic. These results support a role for quail and rats in the natural history of R. parkeri, but the true extent of their role is still unclear.

17. EMILY L. BLIZZARD¹, CHERYL D. DAVIS², SCOTT HENKE³, DAVID B. LONG⁴, MARGARET BECK⁵, AND MICHAEL J. YABSLEY¹, ¹Warnell School of Forestry and Natural Resources and the Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of

Georgia, Athens, GA, ²Western Kentucky University, Bowling Green, KY, ³Caesar Kleberg Wildlife Research Institute, Kingsville, TX ⁴USDA-APHIS-Wildlife Services, Kingsville, TX, and ⁵Goose Creek Wildlife Sanctuary, Tallahassee, FL. <u>Distribution</u>, prevalence and genetic characterization of Baylisascaris procyonis from selected regions of Georgia and Florida.

Baylisascaris procyonis, a parasitic intestinal nematode commonly found in raccoons (Procyon lotor), has historically been absent from the southeastern United States. In 2002, the parasite was first documented in Atlanta, Georgia. The goal of this study was to investigate distribution in Georgia and northern Florida. Intestinal tracts of 207 raccoons from six Georgia counties and 53 raccoons from three northwestern Florida counties were examined for B. procyonis. In Georgia, 12 of 116 (10.3%) raccoons from Clarke County were infected with B. procyonis. A single immature worm from a Florida raccoon was confirmed to be B. procyonis by PCR. No other raccoons were infected. To try and identify a source population for the parasites, we amplified and sequenced regions of the rRNA genes from worms from various locations. To date, ITS-1 sequences have been successfully obtained from 18 worms from Georgia (n=6), Kansas (1), Florida (1), Kentucky (4), and Texas (6). Although numerous polymorphic bases were observed among the samples, none were associated with a particular geographic location. Sequences from the 18S, 5.8S, and ITS-2 regions from six samples from Georgia, Kentucky, and Texas were 100% identical. These data indicate that the distribution of B. procyonis within Georgia is increasing and that limited genetic variation in the rRNA and ITS gene regions is present among widely distributed populations of B. procyonis. In addition, this is the first report of B. procyonis in Florida and increases the distribution of this important zoonotic parasite.

18. ELIZABETH R. GLEIM^{1,2}, L. MICHAEL CONNER³, MICHAEL L. LEVIN⁴, AND MICHAEL J. YABSLEY^{1,2}. ¹Warnell School of Forestry and Natural Resources and the ²Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, GA;³Joseph W. Jones Ecological Research Center, Newton, GA; ⁴Centers for Disease Control and Prevention, Atlanta, GA. <u>Understanding the ecological effects of prescribed fire regimes on the distribution and population dynamics of tick-borne zoonoses: preliminary data.</u>

Prescribed fire has become a common forest management tool, particularly in the southeastern United States. As land-use changes are being implicated in the spread and emergence of disease and vectors around the world, it is critical that we understand the impact that land management practices have on wildlife and human diseases and identify practices which may prevent the spread of disease. To better understand the effects of long-term prescribed fire on tick and tick-borne pathogen dynamics, ten sites in southwestern Georgia with variable prescribed fire regimes (none, intermittent, or frequent burns) were sampled for ticks which were subsequently tested for tick-borne pathogens. During initial field work in summer 2009, 40 adult Amblyomma americanum, 154 nymphal A. americanum, 56 adult A. maculatum, 4,268 larval Amblyomma, 21 adult Dermacentor variabilis, and four adult Ixodes were collected. A. americanum adult and nymphal activity peaked in mid- to late July and A. maculatum adult activity peaked in early to mid-July (no A. maculatum larvae or nymphs were captured). Fewer ticks were collected in burned sites (both intermittent and frequent) compared to unburned sites. Furthermore, distinct differences in tick species composition were observed, with Amblyomma maculatum dominating burned sites, while A. americanum dominated unburned sites. These findings have highlighted a new public health threat in southwestern Georgia, as A. maculatum transmits the causative agent of Rickettsia parkeri rickettsiosis (Rickettsia parkeri). Molecular analysis of ticks for tick-borne pathogens (Ehrlichia, Borrelia, and Rickettsia spp.) is underway.

19. ELIZABETH LYNN¹, RICHARD GERHOLD², LARRY MCDOUGALD¹, ROBERT BECKSTEAD¹ Poultry Science Department, College of Agriculture and Environmental Sciences, University of Georgia, Athens GA. ² Department of Veterinary Pathology, College of Veterinary Medicine, University of Georgia, Athens GA. Determining Virulence Factors in *Histomonas meleagridis*

Histomoniasis (blackhead disease) often causes high mortality in turkeys (50-100%) and morbidity in broiler breeder pullets. However, there is considerable variation in the severity of outbreaks. A national study of H. meleagridis strains is needed to find associations of variants with expression of virulence factors. By understanding the molecular basis of strain variation, virulence factors can be found and new targets for immunization identified. Using sequence information for virulence genes found in Entamoeba histolytica and Trichomonas vaginalis, we have generated degenerate PCR primers and amplified and cloned two cysteine proteases genes from H. meleagridis. Additionally, we are using RNA subtractive hybridization screens to identify differentially expressed genes found in virulent strains but not expressed in attenuated strains of Histomonas. Real-time PCR will be used to determine the expression level of these genes in virulent and attenuated strains. Putative virulence genes will also be expressed alone or in combination in attenuated strains of Histomonas and tested for their ability to confer virulence. To accomplish this, we are identifying the promoters of housekeeping genes in Histomonas through Splinkerette PCR technology and testing their ability to drive GFP expression in transfected Histomonads.

20. CHARLES T. FAULKNER...University of Tennessee College of Veterinary Medicine, Knoxville TN 37996. <u>Prevalence of Dirofilaria immitis in wild canids from Knox and surrounding counties in East Tennessee.</u>

The canine heart worm *Dirofilaria immitis* is an insidious disease producing agent in the companion animal population. The apparent increased incidence of heartworm infection in endemic areas and its occurrence in previously undocumented localities has prompted concern among veterinarians and the pet owning public to better understand the epidemiology of infective reservoirs and the importance of following effective prophylactic programs for its prevention in companion animals. Carcasses of live-trapped nuisance coyotes, gray, and red foxes from Knox and surrounding counties in East Tennessee were examined to estimate the prevalence of heartworm infection in the wild canine population. To date the prevalence of heartworm in coyotes is 50% while none of the gray and red fox examined were infected.

21. SONIA M. HERNANDEZ^{1,2}, SUSAN SANCHEZ³, ROBERT COOPER¹, MICHAEL J. YABSLEY^{1,2}, C. RON CARROLL⁴. Warnell School of Forestry and Natural Resources¹ and the Southeastern Cooperative Wildlife Disease Study, College of Veterinary Medicine², University of Georgia. Department of Infectious Diseases and Athens Diagnostic Laboratory, College of Veterinary Medicine, University of Georgia³. Odum School of Ecology and College of Veterinary Medicine, University of Georgia⁴. Do shade-grown coffee plantations ("Bird-Friendly" coffee) pose a disease risk for Neotropical birds in Costa Rica?

Habitat loss and fragmentation has reached unprecedented proportions and is now the leading cause of wildlife species extinction. The resulting increased "edge effect" and smaller habitat patch area poses a variety of threats to biodiversity, including: 1) promoting biological impoverishment, 2) creating favorable conditions for the persistence of invasive exotic species, 3) favoring the abundance of generalists species and 4) potentially creating points of artificial aggregation or concentration of wildlife. Disease is one of the most understudied factors affecting wildlife populations.

Shade-grown coffee is heavily promoted in the Neotropics as a sustainable agricultural alternative that maintains a diverse and abundant avifauna. However, we hypothesized that the shade-grown coffee plantations, because they are biologically impoverished, promote the persistence of exotic species, favor generalist species in high abundance and are small areas that artificially concentrate wild birds, might serve as disease risks for Neotropical birds. We measured various parameters to estimate health, pathogen prevalence and diversity across 3 replicates of 2 habitat types (shade coffee vs. nearby forest patches). From 2005-2008, we captured 1,550 birds and examined them for body condition, parasite and pathogen prevalence and diversity. Our results were mixed, with some trends indicating that parasite diversity is highest in birds living in shade-grown coffee and wild birds inhabiting these plantations have a higher prevalence of one directly-transmitted disease. Whereby this is unlikely to cause visible mortality, fitness trade-off from investment in immunity are likely to have ripple effects on reproductive output, which can have more subtle, yet important population effects.

22. DANA NAYDUCH AND KATHRYN CLAIRE HILSINGER. Dept. of Biology, Georgia Southern University. Host and seasonal effects on the infection dynamics of the parasitic nematode *Skrjabinoptera phrynosoma* in horned lizards (*Phrynosoma platyrhinos*)

Skrjabinoptera phrynosoma is a common parasitic nematode of horned lizards whose unique life cycle has received little attention. We assessed the effect of season and host characteristics on the infection dynamics in Phrynosoma platyrhinos. Nematodes were collected via stomach and cloaca flushes, and fecal pellets during three collection periods in the active season of 2008. Parasite load variables (sex, number, length, and total worm burden (\(\sum_{\textsf{L}}\)) within lizards) were analyzed both within collection period and across season. Additionally, the relationships between parasite variables and host characteristics (sex, size) were determined. The number of both non-gravid female and juvenile nematodes from lizards' stomachs decreased significantly between early and late collection periods. The number of male nematodes did not change across season; however, their length increased significantly between early, middle and late periods. Host SVL was positively correlated with non-gravid female and juvenile nematode lengths during the early collection period. In late season, there was a negative relationship between lizard SVL and number of gravid female nematodes. Nematodes retrieved from cloacal sampling were exclusively gravid females, with highest prevalence mid-season. We propose that, in lizards with stable male nematode populations, newly-establishing juvenile nematodes develop into non-gravid females, which then mate and become gravid female nematodes, exiting mid-season. Further, in larger lizards, these events may occur more rapidly due to the added space and/or resources available in larger hosts. The observed seasonal and host effects on infection dynamics this system most likely reflect the importance of timing in this unique parasite life cycle.

23. OSCAR J. PUNG, ASHLEY R. BURGER, AND PATRICIA A. O'LEARY. Georgia Southern University. Effect of incubation vessel and worm density on the ability of *Microphallus turgidus* (Trematoda: Microphallidae) to produce normal eggs in vitro.

Most attempts to culture adult digeneans have been unsuccessful. However, metacercariae of *Microphallus turgidus* cultured in our laboratory mature into adults and secrete eggs infective to the hydrobiid snail *Spurwinkia salsa*. The goal of the present study was to determine if the successful in vitro growth of *M. turgidus* is due to some peculiarity of our culture procedures. In our standard protocol, excysted *M. turgidus* metacercariae (n > 50 worms) from grass shrimp (*Palaemonetes pugio*) are incubated overnight at 37 C in a 50 ml conical bottom centrifuge tube containing Hank's balanced salt solution. On the next day the worms are transferred to 24 well, flat-bottom plates (containing 2 ml RPMI-1640 plus 20% horse serum, gas phase = air, 41 C) for cultivation.

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Worms cultured using this protocol secrete significantly more eggs and a higher percentage of normal eggs than worms put into 24 well flat-bottom culture plates immediately after excystation. Furthermore, we observed sperm in the seminal receptacle and uterus of ~50% of worms incubated overnight in a conical bottom tube but not in worms put into culture plates immediately after excystation. We hypothesize that overnight incubation in a conical bottom tube facilitates copulation and subsequent fertilization of oocytes. An experiment is now in progress to compare the infectivity of eggs secreted under both conditions.

24. J. MICHELLE RIVIERE AND STEPHEN C. LANDERS. Troy University, Troy AL. Light and electron microscopic analysis of the parasitic ciliated protozoan *Chromidina*.

The ciliate Chromidina is a relatively unstudied parasite from the renal organs of cephalopods. This report examines the structure of the trophotomont stage using light microscopy and transmission electron microscopy. The ciliates were obtained from the renal organs of the short-finned squid Illex coindetii, collected in the Northeastern Gulf of Mexico on the NOAA ship Gordon Gunter. Whole mount and sectioned material examined by light microscopy revealed details of the cell's unique structure. The cell is covered with spiralling ciliary rows, is elongated (approx. >1500 µm X 32 µm), and has a bulbous anterior attachment end. The most distinctive structure within the cell is the macronucleus, which forms a reticulum that extends throughout the parasite. Numerous vacuoles and mitochondria fill the cytoplasm. Under the pellicle there are darkly stained structures associated with the ciliary rows that are shown by TEM to be kinetodesmal fibers. These fibers are stacked and extend into folds of the outer pellicle on the bulbous anterior end of the ciliate. The specialized structure of the pellicular folds and the kinetodesmal fibers at the anterior end may be used by the ciliate for attachment to the host renal tissue. Further structural details of this specialized cell will be presented. We thank NOAA and the NMFS, SEFSC Mississippi Laboratory for providing ship time and sample collection on the R/V Gordon Gunter.

25. ANURADHA SRIVASTAVA AND DENNIS E. KYLE. University of South Florida, Tampa, FL. <u>Evaluation of novel Arylimidamides in the hamster model of visceral leishmaniasis.</u>

Leishmaniasis, a neglected tropical disease, is caused by parasitic protozoa of the genus Leishmania, including 20 species pathogenic for humans. The current drugs of choice for treatment of visceral leishmaniasis (VL) suffer from well documented limitations, including emergence of resistance, toxicity, parenteral administration, long courses and cost. Arylamidamides (AIAs) have been identified as promising VL candidates in the antileishmanial drug discovery pathway implemented by Consortium for Parasitic Drug Development (CPDD). Submicromolar IC₅₀ values were obtained in the axenic *L.mexicana* and infected macrophage assay with beta lactamase transfected L.amazoenensis and L.donovani. Based upon excellent in vitro activity, and promising in vivo oral efficacy in BALB/C mice VL model, the AIAs DB745, DB766, DB1960, DB1955 were evaluated for efficacy in liver, spleen and bone marrow in Syrian hamsters in our laboratory. The hamster model of VL represents a surrogate of disease progression similar to that seen in humans. A modified Hanson 11 day model of VL in hamster has been established and validated in our laboratory. Till now, most reports are for acute (short term) studies to screen drugs and do not take in account the chronic manifestations of the model that mimic human infections. Therefore, we established a severe infection model (39 days) and all the above mentioned AIA's have been evaluated in both the models. Significant oral activity was observed with all the compounds at 50mg/kg and 100 ma/kg doses. The data also confirmed bioavailability of the compounds. We will report test results of all the compounds.

26. ANDREA VARELA-STOKES, ASHLEY CASTELLAW, FLAVIA GIRAO, GAIL MORARU, ERLE CHENNEY, AND CLAIRE FELLMAN. College of Veterinary Medicine, Mississippi State University. <u>Variable membrane protein genes in the tickborne bacterium</u>, *Borrelia lonestari*.

Borrelia lonestari is a spirochete vectored by the lone star tick, Amblyomma americanum. Although it was associated with one case of "southern tick-associated rash illness" (STARI), there has been no further evidence supporting its role as the causative agent. Thus, unfortunately, its potential role in human and animal disease remains unclear and its natural history is only beginning to be understood. Because B. lonestari is more closely related to relapsing fever spirochetes, we hypothesized that the genes responsible for causing relapses would be present in B. lonestari and that the expression of these genes would change during infection. The variable membrane proteins (vmps) are responsible for mediating antigenic variation in the relapsing fever spirochete, Borrelia hermsii, and are divided into the vlp and vsp families. We found evidence of three of four vlp subfamilies (vlpα, vlpβ, vlpγ) and the vsp family, using family and sub-family specific primers, in B. Ionestari (LS-1 strain). For the infection study, we transmitted B. Ionestari to white-tailed deer via feeding infected ticks; three exposed deer became infected as demonstrated by PCR. Our studies to identify the expressed variable membrane protein are underway, however in a previous study using B. lonestari-infected deer, we were able to detect presence of a variable membrane protein gene at the expression site using primers specific for that site. We anticipate that results of this study will be able shed light on the potential for B. lonestari to evade the immune system and possibly its role in human and animal disease.

27. MICHAEL J. YABSLEY^{1,2} ELIZABETH HORNE³, AND NOLA J. PARSONS⁴. ¹Daniel B. Warnell School of Forestry and Natural Resources, ²Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens Georgia, USA, ³Penguins Eastern Cape Marine Bird Rehabilitation Center, Cape St Francis, South Africa, ⁴Southern African Foundation for the Conservation of Coastal Birds, Cape Town, South Africa. <u>Novel relapsing fever Borrelia detected in African penguins admitted to rehabilitation centers in South Africa</u>.

The African penguin, Spheniscus demersus is the only penguin species that breeds in Africa, The population of African penguins is about 10% of that at the start of the 20th century when it was estimated at over 1.45 million adult birds. African penguins are classified as vulnerable and current threats include oil spills, guano and egg collection, reduced food availability, and diseases (aspergillosis, babesiosis, and malaria). From 2002 - 2009, spirochetes morphologically consistent with Borrelia were observed on blood smears from 31 of 4,026 (0.77%) African penguins admitted to two rehabilitation centers in South Africa. Infections were detected in penguins from both coasts with 6 of 650 (0.92%) penguins from the east coast being positive 25 of 3,376 (0.74%) penguins from the western coast being positive. The majority of infections were detected in the summer (Oct-Feb, 28/31 positives) and in younger birds (14 chicks, 13 blues, and four adults). Three of the infected penguins died of suspected borreliosis, one of which had spenomegaly, splenic reticuloendothelial hyperplasia with hemosiderosis, edematous lungs, and moderate, subacute, lymphocytic meningoencephalitis. However, the pathogencity is unknown because some penguins did not receive treatment and survived. Analysis of partial flaB gene sequences indicated the spirocheate was a relapsing fever Borrelia most similar to a Borrelia sp. detected in soft ticks from a seabird colony in Japan. This represents the fourth report of a relapsing fever Borrelia sp. in an avian species and suggests that borreliosis might be a concern for African penguins.

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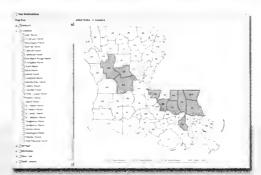
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Paper and Poster Abstracts

From the 53rd
Tri-Beta Annual Meeting

Held with the 71st
Annual ASB Meeting

Co-Hosted by

Western Carolina University and University of North Carolina

Asheville, North Carolina

April 7-10, 2010

Paper Presentations Southeastern District I

Agee, Justin. Kappa Kappa, Augusta State University. Lunar Cycle Effects on *Anchoa mitchilli*, the Bay Anchovy.

Anchoa mitchilli, the bay anchovy, is a small prey fish that is associated with marine and estuarine environments. The goal of this research project was to determine the effect of lunar cycles on the abundance of these prey fish during the spring months of March, April, and May. This study will help us gain an understanding of the habits of the anchovy, determine food availability for game fish species, and ascertain a measure of population variability. The collections were performed on St. Catherine's Island, a barrier island located on the coast of Georgia that is dedicated to research and education. Samples were taken monthly for a ten-year period from 1998 through 2008, using various seining techniques. Analyses were performed by first establishing a baseline of anchovy sizes. It was necessary to eliminate reproductive surges in the population and limit subsequent analyses to the adult prey fish. The sorted data was compared to lunar cycles provided by the National Aeronautics and Space Administration website. The information was then examined to determine any cycles, trends, and relationships. Data analyses reflect an association between lunar cycles and bay anchovy abundance during the spring months.

* Andryszak, Alex. Sigma Gamma, Erskine College. Born in the Wrong Sea: A Look at the Caribbean Invasion of the Lionfish.

The lionfish is a species normally found in the warm waters of the Pacific and Indian Oceans. Since the first sighting in the Atlantic, in 1992, they have spread rapidly as far north as Rhode Island and as far south as Panama and declared extremely invasive. In the Cayman Islands the government is currently undertaking measures to prevent or at least delay the growth of the lionfish in the local waters as well as monitor the primary stage of invasion. These measures included licensing 233 local dive masters to catch lionfish. The lionfish were caught through a technique using nets and spear guns. All specimens that were caught were sent to the Cayman Island's Department of Environment where they were measured, sexed, and their gut content was checked. The catch sites were also recorded to show a trend in the distribution and to determine the hardest hit areas of the three islands that make up the Caymans. 415 specimens were analyzed. The average size caught per month increased by 45% over the span of three months. Through the gut content analysis we were able to see that the fish populations hardest hit by the lionfish were the algae eaters and cleaner fish in the blenny and wrasse families. There were snapper and grouper in the gut analysis as well. With sexing the fish, it was found that the distribution of males to females was 50/50. This is a most unusual find for fish because very few populations have a 1:1 ratio between the sexes. Also, no fish were found with egg sacs until late August which can lead us to believe that the fish were not reproducing in the months leading up to this find. These results show the affect of lionfish during the primary stage of invasion and show that these measures instituted by the Cayman Island Government were not affective in preventing the reproduction of lionfish on Grand Cayman.

Berg, Laura S. Alpha Pi, Mary Baldwin College. An Examination of the Use of *Bacillus subtilis* as a Biological Control Agent of Chestnut Blight (*Cryphonectrica parasitica*).

Cryphonectrica parasitica, commonly known as Chestnut Blight, was introduced to the United States in 1904, completely changing the composition of the Eastern forests of North America. In a 1998 study, E. Wilhelm suggests that Bacillus subtilis could be used to help restrict hyphalgrowth in Chestnut (Castanae dentata) seedlings and decrease the

development of cankers. In another 1998, S. Gao suggests that *C. parasitica's* main method of infection is through the use of polygalacturonase. Based on these studies I suggest that *B. subtilis* releases an inhibitor of polygalacturonase, which would therefore restrict hyphal growth by preventing the breakdown of the cell wall. Through the use of starch tests, exoprotein extraction, enzyme assays and kinetics studies, I confirm the presence of polygalacturonase in *C. parasitica* exoprotein extract, and examine whether or not *B. subtilis* releases a polygalacturonase inhibiting protein or any other form of polygalacturonase inhibitor.

Diggs, Elliot. Sigma Phi, Guilford College. Examining Population Structure in Two Species of Australian Freshwater Turtles.

Population structure, such as ecological niches and demography, is critical to freshwater turtle conservation. Two important aspects of population structure are age class and sex ratios. Age class ratios compare juvenile and adult subpopulations. Sex ratios compare breeding pairs (adults) and future breeding pairs (juveniles). I examined these ratios in Elseya stirlingi and Wollumbinia latisternum populations in four pools in the North Johnstone River, Queensland. Data shows that pools varied in age class ratios. W. latisternum populations favored juveniles for most pools. Two pools favored E. stirlingi juveniles and two pools favored adults. These results correlate with data from past assessments. Sex ratios differed for both species. E. stirlingi favored females in two pools and two favored males. For adult E. stirlingi, the same trend occurred within the pools. W. latisternum favored females in two pools and two favored males with one pool having no adults. W. latisternum's overall trend was unaffected as most pools had more adult males. Collectively, both species' sex ratios were approximately equal and both populations skewed toward adults. These ratios are consistent with the hypothesis that both populations would skew toward adult females and suggest that the species are shifting toward a stable population structure.

Jackson, Lindsey M. and Sue K. Calcagni. Tau Eta, Catawba College. A Common Antibiotic Alters Key Physiological Processes in a Freshwater Crustacean.

Antibiotics rule in the fight against bacterial infections in Western medicine, but few physicians and patients stop to consider what happens to these drugs after excretion or disposal. Numerous studies have shown that pharmaceuticals are detectable in surface waters around the world, but the effects of these compounds on aquatic organisms are largely unknown. In the present study, common freshwater crustaceans (*Daphnia pulex*) were exposed to water-borne kanamycin at concentrations of 1.0, 10, and 100 ug/L for a duration of 14 days. Data were collected every 48 hours and included measures of growth, feeding, and reproduction. Relative to the control treatment, kanamycin significantly reduced molting in the 10 and 100 ug/L treatments. Kanamycin also significantly reduced feeding and the number of offspring in all treatments. Because daphnids are part of many freshwater food webs, we conclude that kanamycin, and perhaps other antibiotics, may have the potential to negatively impact aquatic life and ecosystems. Further studies are certainly warranted.

Gregory, Courtney A. and Nicole J. Woller. Tau Pi, Wofford College. CbbR as a Potential Regulator of Carbon Dioxide Usage in *Halothiobacillus neapolitanus* and *Thiomonas intermedia*.

Halothiobacillus neapolitanus and Thiomonas intermedia are chemoautotrophic bacteria that fix carbon dioxide (CO₂) into compounds used for energy via the Calvin-Benson-Bassham (cbb) cycle. The process is initiated by one of two forms of the enzyme ribulose bisphosphate carboxylase/oxygenase (RuBisCO). Form I RuBisCO is the predominantly expressed form under normal atmospheric levels of CO₂ (0.03%), while Form II RuBisCO

production increases when cells are grown at higher levels (5.0%). The mechanism used to regulate production of the two forms has not been elucidated; however, a protein called CbbR has been shown to regulate CO₂ fixation in other prokaryotes by binding to a regulatory region of DNA near the RuBisCO genes. The purpose of this project was to determine if CbbR is a potential regulator in *H. neapolitanus* and *T. intermedia* by performing electrophoretic mobility shift assays (EMSA) to assess the protein's ability to bind to the upstream regions of DNA of both *cbbL*, the form I gene, and *cbbM*, the form I gene. It was hypothesized that CbbR would bind to the regulatory regions of both forms. Results from the EMSA showed a shift of DNA upwards, indicating the binding of CbbR to the upstream regions of *cbbL* and *cbbM*.

Johnson, Tonya, J. W. Brown, and Melanie J. Lee-Brown. Sigma Phi, Guilford College and North Carolina State University. Inactivation of the FMN riboswitch in *Pseudomonas aerugionosa*.

Riboswitches are gene expression control elements that consist of complex folded domains within mRNAs. Fourteen classes of riboswitches have been identified in microbial genomes. Riboswitches bind specific metabolites, resulting in changes in the structure of the mRNA that modulate transcription or translation, resulting in changes in the level of gene expression. The flavin mononucleotide (FMN) riboswitch regulates transcription of the rib operon by binding FMN and forming a transcriptional terminator reducing the expression of downstream genes. FMN is derived from riboflavin (vitamin B2) and is used as an electron carrier in the electron transport chain during respiration in respiring microbes. The Pseudomonas aeruginosa genome contains an FMN riboswitch in the rib operon. P. aeruginosa is an opportunistic human pathogen that is the primary etiological agent of nosocomial infections. P. aeruginosa also infects Caenorhabditis elegans; in this study, this interaction will be used as a model infectious system. The hypothesis is the inactivation of the FMN riboswitch will decrease the virulence of P. aeruginosa. We will determine if P. aeruginosa can bypass the FMN pathway utilizing riboflavin captured from its host. This analysis will help to determine whether the FMN riboswitch could be used as a potential target for novel antimicrobials.

Lachance, Sara. Sigma Phi, Guilford College. Identifying Dachshund's role in Hedgehog Signaling and Urchin Development.

The PAX gene family contains nine genes that make up four different subgroups. These genes all play a critical role in organ and tissue formation during development. The PAX 6 genes, a subgroup of the PAX genes, co regulates along with the gene dachshund, in organ and tissue formation. In vertebrate embryos the Dachshund gene termed Dach-1, has been reported to be part of the PAX genes and play a central role in ocular development. Dach-1 is a key component in the RDGN (retinal determination gene network) and participates in initiation of the morphogenetic furrow. It is believed that Dachshund is evolutionarily conserved between species; however the role that Dachshund plays in invertebrate development is unknown. The goal of this research is to determine Dachshund's role in invertebrate development using the urchin species L. variegatus. At the start of this research, the gene sequence of Dachshund was unknown in L. variegatus. In this study degenerate primers were found from taxonomy reports of Danio, Pediculus, Strongylocentrotus and Saccoglossus and were used in order to clone the sequence from genomic DNA isolated from L. variegatus. This sequence will then be used to develop an in situ probe in order to determine where Dachshund is commonly expressed in L. variegatus development. We will also develop an L. morpholino in order to knock-down gene expression in L. variegatus embryos over the developmental period.

Hannon, Authur. Sigma Psi, Florida Institute of Technology. Behavioral Biology of the Endangered Perdido Key Beach Mouse, *Peromyscus polionotus*, in Captivity.

The Perdido Key beach mouse is one of a group of subspecies of the oldfield mouse that inhabits the endangered dune habitat of southeastern coastal areas including barrier islands that are being developed at an extremely rapid pace. These rare mammals are also rare among mammals in that they form mating pairs for life. There has been almost no behavioral biology done on these mice, so I set out to describe the suite of behaviors exhibited in a captive colony that is being bred for reintroduction into the wild. I used remote videography to record and analyze behaviors around the clock in a light-dark cycle, and tested the effects of different habitats on behavior. Simplest habitats (small plastic cages with shavings for bedding- the type used for rearing domestic mice, Mus musculus) rapidly generate abnormal repetitive behaviors that occur for extensive lengths of time. In highly enriched artificial habitats (deep sand substrate, grasses, logs, etc.), most mice exhibiting repetitive behaviors either lost or reduced the frequency of repetitive behavior, built complex tunnels similar to those in the wild, and formed pairs and reproduced repeatedly. Mice born in these complex habitats never exhibited abnormal repetitive behavior. I am also testing the effects of different daylengths in an LD cycle to determine how season affects reproductive output. This work is the first detailed analysis of P. polionotus behavior in captivity, and will be an important component of beach mouse conservation on Perdido Key and elsewhere.

*District I Brooks Award Winner, Best Paper

Paper Presentations Southeastern District II

Shelley, Elizabeth Ann. Mu Iota, Northern Kentucky University. Decontamination Strategies to Stop the Spread of White Nose Syndrome.

White-Nose syndrome (WNS), caused by the fungus *Geomyces destructans*, has been decimating hibernating bat populations in caves in the Northeast US. There is some evidence that WNS could be spread via the equipment used by cavers. We therefore focused on finding a protocol for decontamination this equipment by testing the efficacy of cleaning agents and organic compounds in killing fungal spores. Three different assays were used involving live cultures of *Geomyces pannorum* and a strength test was performed on treated rope. The protocol we developed involved treatment of equipment via washing in Woolite followed by treatment in a Lysol ICS solution for fifteen minutes.

Cummins, Christin. Mu Chi, Midway College. The Effects of Epigallocatechin-gallate on the Photokilling of *Staphylococcus aureus* by Curcumin.

Curcumin is an herb found throughout Asian countries that has been used for the photokilling of various bacteria. Curcumin has been previously shown to be a photosensitizer, that when illuminated, reacts with the light to produce highly reactive forms of oxygen such as singlet oxygen which has been shown to be damaging to cells. Epigallocatechin-gallate is known to exhibit antioxidant properties. This experiment was conducted to test the ability of epigallocatechin-gallate to inhibit the killing of *Staphylococcus aureus*. To try and protect bacterial cells from the reactive oxygen species produced by curcumin, the oxygen quenching substance epigallocatechin-gallate was included in a solution of curcumin and *Staphylococcus aureus*. At 0, 10, 20, and 30 minute times of exposure to light, aliquots were drawn and spread onto Trypticase Soy Agar plates. Plates were incubated in the dark overnight and colonies were counted. The results showed that without epigallocatechin-gallate, 100 percent of the colonies were killed within 30 minutes. When 1.0 x 10⁻⁴ M epigallocatechin-gallate was administered it provided protection, slowing the rate of photokilling, showing an increase of 33 percent survival after 30 minutes.

Fischer, Ashley P. Mu Chi, Midway College. Birdfeeder and Birdseed Preferences/ Associations Along a Riparian Zone: a Continuing Study.

Birdfeeder and birdseed preference and association studies have been conducted in various areas with more support provided by secondary literature than primary literature. Birdfeeder and seed studies are wanting in Kentucky. Birdfeeder and seed work were conducted for six weeks along a riparian zone in Midway. Kentucky during the summer of 2009. Bird perching on a feeder served as the criterion for preferences and associations. For the birdfeeder work, significant preference for feeder-type was platform, followed by hopper, followed by tube. Significant feeder-type associations were blue jay (platform), woodthrush (hopper), cardinal (platform), Carolina chickadee (tube), field sparrow (hopper), American tree sparrow (hopper), titmouse (platform), and veery (hopper). For the birdseed work, birds showed a significant preference for black-oil sunflower seed, followed by safflower seed, followed by white proso millet (WPM) seed. Significant seedtype associations were blue jay (WPM), titmouse (black-oil), cardinal (black-oil), Carolina chickadee (safflower), downy woodpecker (black-oil), field sparrow (WPM), and mourning dove (WPM). A checklist was developed from the observations made for birdfeeder and seed work over the six week study. Some bird identification could be invalid due to misidentification.

*Wells, Madison L. Mu Chi, Midway College. Prevalence of Methicillin-Resistant Staphylococcus aureus (MRSA) on meat products in Central Kentucky.

Methicillin-Resistant *Staphylococcus aureus* (MRSA) was isolated from 10 (18.5%) of 54 meat samples collected in central Kentucky. Meat specimens were collected from six local markets in the central Kentucky region. MRSA found in meat samples may be a possible source for community-associated infections of MRSA. There were nine samples obtained from each location. (18 pork, 18 beef, 18 processed meats) The specimens were placed on ice for transport to the lab where they were individually processed using an aseptic technique. Meat samples were streaked for isolation on mannitol salt agar plates and placed in 7% salt enrichment broth upon arrival in the laboratory. The positive specimens accounted for 27.7% of both pork and beef samples tested.

Arias, Daniela, Sarah Brown, Zack Sejan. Sigma Gamma, Erskine College. Analysis of Fecal Bacterial Growth on Various Pet Bedding Materials.

Small mammals, such as hamsters, gerbils, and guinea pigs, are common household pets. These animals have been shown to carry bacterial diseases, such as Salmonella infections, that can be passed on to other animals or humans. Approximately 4.5 million households in the United States of America have small mammal pets, with an average of 2.4 pets per household. In 2005, the Centers for Disease Control issued a warning concerning an outbreak of multidrug-resistant Salmonella associated with small mammals sold at pet stores. Transmission of such infections commonly occurs through contact with feces from the infected animal. This project investigates the growth of fecal bacteria on six different commercially available pet beddings materials using a standard plate count technique. Results from the experiment show that reclaimed cellulose fiber bedding and corncob litter function best in limiting the total number of E. coli cells recovered from the bedding material 48 hours after inoculation. The commonly recommended aspen bedding, along with cedar shavings, showed significantly higher levels of bacterial recovery following incubation. These results suggest that the use of reclaimed cellulose fiber bedding and corncob litter can limit the transmission of potentially pathogenic bacteria, providing greater health benefits to the pet and owner.

Schabel, Amy. Mu Omicron, Columbus State University. Classification of Seasonal Bacterial Populations Growing in a *Sarracenia rubra* Pitcher.

Carnivorous plants are unique because they depend on other organisms for nutrients. A pitcher plant is a carnivorous plant; its morphology attracts small insects into their water filled pitchers. Inside the pitcher, enzymes from the plant digest the insect exoskeletons which then provide nutrients for the plant. Many scientists think bacteria within the pitcher contribute to the breakdown of insects. My six month project will focus on two pitchers of *Sarracenia rubra* and their bacterial communities. I expect that bacterial communities within different pitchers will differ from one another and change seasonally. This project will be done by sampling 4mL of water from two pitchers. Samples will be diluted and plated on LB agar media Petri plates. Petri plates will be observed for two days. Other parameters like temperature, oxygen, ammonia, and pH levels will be taken from the pitcher's water samples. With this data I will correlate change in the bacterial communities with changes in the environmental parameters. Gram stain tests will be performed to give preliminary identification of the bacterial communities. At the end of the six month time period analyses will be done to determine if the bacteria changes seasonally and from pitcher to pitcher.

Lincoln, Fugal S. Mu Iota, Northern Kentucky University. Impact of Invasive Shrub Amur Honeysuckle on Soil Water Uptake in a Wetland Forest.

The impact of Amur honeysuckle on soil water uptake was compared at old- and second-growth wetland forest sites. The basal area of Amur honeysuckle at the second- growth site was about 5X greater than at the old-growth site, and the honeysuckle there transpired a rainfall equivalent of about 7 mm, 5 X greater then at the old-growth site. In both sites, the honeysuckle actively transpired for weeks after native plants had lost their leaves. This may decrease the lifetime of the ephemeral ponds in the wetland and thus negatively affect the animals that require them.

Ledet, Russell, Mei-Chyi Tan, and Wesley Gray. Eta Mu, Southern University, Baton Rouge. Exploring the Gene Networks of Bizzy Nut.

Kola acuminate, also known as Bizzy Nut or Kola Nut, is a natural product that contains bioactive chemicals that possess hormonal properties. Work from our laboratory has shown that Bizzy is able to inhibit prostate cancer cell growth, suggesting that this extract may contain chemopreventative properties. The growth of prostate cancer cells is influenced by several genes and factors. Changes in prostate cells gene expression under different cellular conditions have been attributed to the appearances of different types of prostate cancers. The gene network that is required for development of prostate cancer is largely unknown. Furthermore, the gene networks associated with Bizzy induce gene expressions which affect prostate cancer development has yet to be explored. Since Bizzy contains putative chemopreventative and anticancer properties, we hypothesized that Bizzy will modulate the expression level of genes that are involved in tumor carcinogenesis. Therefore, the objective of this study is to generate a Bizzy specific gene network map by identifying, analyzing, and characterizing Bizzy-inducable genes that are involved in the prevention or delay in development of prostate cancer. As an initial step in accomplishing our objective, cDNA of Bizzy responsive genes will be cloned into pGEM plasmid vector and, then amplified and isolated utilizing the QIAprep Spin Miniprep Kit. The plasmid DNA will be arrayed into several 384 gene clusters and their size, location, DNA sequence, level of expression, and function will be determined. We expect to see correlation between genes involved in cell proliferation and apoptosis clustering together in the presence of Bizzy. The availability of this resource (Bizzy specific Gene Map) will allow us to make conclusions concerning the efficacy of Bizzy in prostate cancer prevention.

*District II Brooks Award Winner, Best Paper

Paper Presentations Southeastern District I and II

Macy, Aaron P. Sigma Psi, Florida Institute of Technology. Metabolic Response in Mangrove Killifish to Emersion and Hypoxic Conditions through NMR Spectrometry.

Kryptolebias marmoratus is a fish that inhabits tide pools and has unusual methods to cope with the falling water level. They hide in crab burrows, and so when the tide goes out, they are trapped in small pools of stagnant water that slowly accumulate toxic H_2S . The fish have been known to jump out of these pools, and they have adapted to living out of water as well. In our study, we track the levels of 7 different phosphorous-containing compounds under normal (receiving aerating water), hypoxic, and emersed conditions using NMR spectrometry. We accomplish this goal by positioning the live organism in the space between a 5 mm NMR tube inside a 10 mm NMR tube. Studies have shown a certain ratio for levels of phosphocreatine and inorganic phosphate under normal conditions. That ratio is accentuated in a lack of water, and the ratio reverses under hypoxic conditions. The particular ratio is dependent upon the individual fish, but the trend is consistent with the species. Special thanks to Jon Shenker, Dan Wagner, and Scott Taylor for technical assistance.

Daniel, Chelsea. Beta Zeta, University of North Alabama. Nematode Nightmares! Predators and Parasites and Soil and Moss Dwelling Nematodes from Urban Areas, Florence, Alabama.

Nematodes can be found in almost all environments from terrestrial to aquatic with about 16,000 species being described out of an estimated 100,000 species. Many species are free-living while others are major parasites of vertebrates, invertebrates, and plants. Most species of soil dwelling nematodes are free-living and play a beneficial role in the decomposition of organic matter through the recycling of nutrients and minerals. Beneficial free-living nematodes are fed upon and thereby destroyed by other organisms in the complex interactions of micro-communities. This study investigated the predators and parasites of free-living nematodes in soil and mosses collected during January, February, and March, 2010, from the grounds of the University of North Alabama campus and the surrounding residential area. Baermann pans were used to extract both nematodes and their predator/parasites. Drechsler's soil sprinkling technique was used to enhance water agar cultures inoculated with the Baermann pan extracts. Cultures were examined approximately twice a week for eight weeks. Tardigrades, endoparasitic fungi, and other nematodes were observed destroying soil and moss dwelling nematodes. Tardigrades and the endoparasitic fungi Harposporium and Catenaria were the most frequently observed destroyers of free-living nematodes from urban environments.

Obregon, Veronica, Antigone Childs, Xochitl-Arzeta Ferrer, and Neval Erturk. Nu Xi, Converse College. Inhibition of Colchicine-induced genotoxicity in Rats by Herbal Supplement Canlmmu.

CanImmu is an herbal supplement advertised to both prevent and cure cancer in humans. The effects of CanImmu as a prevention for Colchicine-induced genotoxicity were investigated in albino rats through the use of micronucleus tests. The CanImmu was administered orally once a day for 28 days to two groups, with two other groups receiving water. One CanImmu and one water group were then intraperitonealy injected with an acute dose of Colchicine, a genotoxic substance. The rats were euthanized by cervical dislocation 48 hours following injections. Bone marrow from the femurs was harvested and used to prepare smears. After staining with buffered Wright stain, the smears were viewed under a microscope to observe the number of micronucleated cells relative to the number of erythrocytes. A significant (p < .05) decrease in the number of micronucleated cells was

observed in the group that received the supplement Canlmmu and Colchicine when compared to the group which only received Colchicine. This suggests the supplement has a preventative effect on Colchicine-induced genotoxicity.

Stevens, David. Sigma Gamma, Erskine College. Diabetes-Induced Oxidative Stress Activates Renal ET-1 Production.

Nearly half of new cases involving renal failure are directly related to diabetes. Hyperglycemia resulting from diabetes has been shown to induce renal oxidative stress and increase production of the vasoconstrictor molecule endothelin-1 (ET-1) in the kidneys. It is not fully understood if there is a relationship between reactive oxygen species (ROS) and ET-1 activation specifically in diabetes. To examine the role of diabetes-induced oxidative stress in activating renal ET-1 production, renal inflammation, and renal injury, diabetic male Sprague-Dawley rats were treated with the antioxidant drugs Tempol or MitoTempol, and the levels of oxidative stress, renal ET-1 production, and renal injury were measured. Urinary excretion of thiobarbituric acid reactive substances was significantly less in Tempol-treated rats, as was glomerular ROS in Tempol-treated rats according to dihydroethidium staining. Urinary excretion of H2O2 tended to be higher in Tempol-treated rats, though it was not significantly increased. Tempol treatment also significantly decreased urinary excretion of ET-1. Finally, glomerular permeability tended to be lower in Tempol-treated rats. The free radical scavenger Tempol was an effective antioxidant and reduced ROS presence in the cell. Tempol reduced urinary excretion of ET-1. Reducing ROS did not decrease renal inflammation and injury. MitoTempol was an ineffective antioxidant.

McLean, Randal and Emma Weavil. Sigma lota, Peace College. PCB Accumulation in Aquatic Biota Inhabiting an EPA Superfund Watershed.

The Ward Transformer Company is located in a predominantly industrial area of Raleigh (Wake County), North Carolina. The facility was built in 1964 and operated until 2006 when it was closed as a designated EPA superfund cleanup site due to elevated levels of polychlorinated biphenyls (PCBs), among other toxins and carcinogens. The US Department of Health and Human Services have reported PCBs in water, sediments and fish downstream of the facility, and fish consumption advisories are currently in effect for the water bodies related to the Ward Site in the Briar and Crabtree Creek tributaries. We assayed water, sediments and the biota from seven sites in this drainage system and found PCB's at all sites with variable concentrations distributed from the contamination site toward the confluence with the Neuse River. While PCBs may be transmitted cutaneously, most exposure is through ingestion where the chemicals accrue in lipids within organisms and are not excreted. As such, our data suggest differentiated accumulation between muscle and visceral tissue, with especially high concentrations in some fish species having high seasonal adipose deposition. Examination of all aquatic invertebrate and fish species tested revealed elevated PCBs, and relative concentrations among trophic levels suggest biological magnification may be evident.

Shields, Robert. Rho Theta, Thomas More College. Analysis of Two Germ Line Variants of the TGFBR1 Gene in Ovarian Cancer Patients.

Germline variations in the TGF- β R1 have been found to be associated with several human cancers suggesting a role in tumor progression. Ovarian cancer (OvCa) ranks first in gynecologic cancer related mortality. At diagnosis, OvCa has usually progressed to advanced stages of the disease but discovering biomarkers could increase the odds of earlier detection. Here, we analyzed two genetic variants in the $TGF\beta R1$ gene for their association with ovarian cancer. One is an intronic variant, $G \rightarrow A$ polymorphism (Int7G24A), which is 24 base pairs downstream of the intron-exon 7 boundary. The other

is a 9 base pair in-frame deletion ($TGF\beta R1*6A$) in exon 1 of $TGF\beta R1$ resulting in a short signal sequence. Employing capillary electrophoresis (CE) techniques as well as restriction fragment length polymorphism (RFLP), we analyzed tissue specimens from 149 patients with OvCa and 110 non-cancer female controls. CE was found to be a more reliable genotyping technique than RFLP which suffers from problems such as incomplete digestion. The frequency of homozygous Int7G24A in OvCa patients is significantly greater (p = 0.023) than in women who do not have cancer. The wild type/wild type (WT/WT) patients significantly decreased (p = 0.008) going from patients with low malignant potential, to invasive, to metastatic OvCa. Therefore, we conclude that a homozygous Int7G24A variant genotype is significantly associated with OvCa progression.

Hardgrave, Emily, Jennifer Johnson, Thomas Jones, and Darrell Moore. Pi Delta, East Tennessee State University. An Investigation into Queen Bee Intelligence.

Honey bee workers are well known for their large behavioral repertoire, including nursing larvae, grooming the queen, making honey, foraging, guarding, and, of course, the famous "dance language." In contrast, the queen is thought to be a little more than a boring, unintelligent, egg-laying machine. However, very little research has actually addressed queen behavior directly. Honey bee queens were observed over several 24-hour periods to determine fundamental parameters (including walking rate, walking duration, standing duration, directionality, time between laying instances, and distance travelled per minute) that describe her behavior. Next, an agent-based model (the virtual queen) was constructed using NetLogo software, incorporating these parameters. Simulations of random locomotor activity in virtual queens were compared with patterns of movements in natural queens. The data thus far indicates that honey bee queen movements are non-random.

* Shirey, Kristin, Sunde Jones, and James Rayburn. Mu Phi, Jacksonville State University. Preliminary Developmental Toxicity and Comparison of the Tarantula Species, *Grammostola rosea* and *Haplopelma lividium*, on embryos of *Xenopus laevis*.

Tarantulas are the largest spiders in the world. As they become more common in the pet trade, questions about the effects and components of their venom have arisen. Many types of venoms are known to contain toxins which have pharmacological actions. However, the exact mode of action of tarantula venom is unknown. Some isolated peptides have been shown to block various ion channels. To obtain the venom for the experiment, the tarantulas were anesthetized using carbon dioxide. The tips of the fangs were placed into a vile and electric stimulation was applied the fang base to stimulate venom flow. We performed a 96hr test with petri dishes with 20 embryos in each dish. Venom concentrations ranged from 0-0.2% (v/v). We recorded the mortality and analyzed the data with PROBIT analysis using Tox tools. We were able to generate a 96 hr embryo LC50 and EC50 for both species. The *Grammostola rosea* venom had an approximate 96 hr LC50 of 0.044% (v/v) and an EC50 of 0.029% (v/v). It also showed a consistent spinal malformation and growth reduction. The *Haplopelma lividium* venom had an approximate 96hr LC50 of 0.06% (v/v) and an EC50 of 0.091% (v/v).

*District I and II Brooks Award Winner, Best Paper

Poster Presentations Southeastern District I

*Anderson, Jessica, Steven Lloyd, and Ryan Shanks. Psi Rho, North Georgia College and State University. Methamphetamine directly effects the BV-2 murine microglia cell line.

Methamphetamine (METH) abuse causes damage to dopamine (DA) nerve endings activating microglia, the dominant immune cells in the brain. Microglia are innate macrophage cells, which recognize and phagocytose cellular debris caused by neuronal damage. Microglia also initiate changes in the expression of inflammatory signaling molecules. Dysregulation of these microglia inflammatory responses leads to enhanced neuronal damage. Although this has been well documented in response to DAergic nerve terminal damage, it is not clear whether METH has a direct effect on microglia. We modeled the *in vivo* microglia response to METH using a murine microglia cell line (BV-2), which mimics the *in vivo* microglia functional activity and mRNA expression profile. Our data demonstrate direct, dose-dependent effects of METH on microglia within a physiologically relevant range. This response was also measured in a model system mimicking the *in vivo* environment with regard to cellular damage. METH directly inhibits microglia phagocytosis, but this response was attenuated in the presence of cellular debris. We are currently investigating the mRNA expression changes within these model systems.

Hai, Xueying and Christine Fleet. Eta Iota, Emory and Henry College. Wild or Mutant? Hox gene regulation in Gibberellin biosynthesis.

The plant hormone gibberellin (GA) has long been known to modulate development throughout the plant life cycle. Previous studies have shown that different seed types have demonstrated different responses to GA. In order to further understand the regulation of Hox gene in GA biosynthesis, we carried out a study on the homozygous recessive mutant form of the Hox gene (hdg11) to observe the difference. We performed Paclobutrazol (PAC) assays and RNA expression analysis in Arabidopsis thaliana to examine phenotypic and transcriptional effects of the mutations. For RNA expression, we have found that many GA biosynthesis genes show higher expression in a weak allele of hdg11 relative to wild type. Based on our preliminary data from each assay, we found that homozygous recessive mutants react comparatively better to PAC growth inhibitor than the wild types because the difference in hypocotol length between control plates and experiment plates is smaller. Our further work will look at GA biosynthesis in stronger alleles in hdg11 to be able to draw more conclusions about regulations of GA production.

Camak, David, Pengfei Xuan, and Anna Blenda. Sigma Gamma, Erskine College and Clemson University. Analysis of the Phenotypic Traits in Cotton Linked to the Genetically Mapped Molecular Markers.

The cotton plant has had a long history as an agriculturally and industrially important crop. Through approaches of molecular breeding, species of cotton having characteristics of interest and associated with certain genes could be crossed to produce progeny with desirable traits, thus providing higher quality cotton. To determine the location of particular genes on cotton chromosomes, researchers have identified numerous DNA molecular markers linked to those traits. In 2004, Clemson University created the Cotton Marker Database (CMD, www.cottonmarker.org), a website providing public access to cotton molecular markers, many of which are linked to agriculturally important traits in cotton. As part of an ongoing project, the goal of this research has been to collect, analyze and annotate the information about the cotton molecular markers linked to a number of

agriculturally important traits in cotton, focusing specifically on simple sequence repeat markers (SSR). Results included annotation of 29 agriculturally important traits in cotton, 142 SSR markers associated with those traits. Overall, 15 crosses/genetic maps were analyzed. The results have been uploaded into the CMD and are publicly available for the cotton research community worldwide at www.cottonmarker.org.

Barnett, Eddie, Jonathan Brink, Alex Collier and Brett Larson. Tau Chi, Armstrong Atlantic State University. Visual and chemical cues of native and exotic species of fish predators do not impact larval development of southern toads.

In this study, the impact of native and exotic species of predatory fish on the development of relatively unpalatable tadpoles of the southern toad (*Bufo terrestris*) were examined. Toad tadpoles were reared in 20 cm diameter PVC pipes drilled with aeration holes to allow water flow. These PVC "chambers" were submerged in 75 L aquaria. In half of the treatments, the chambers were white, preventing any visual cues between predators and prey. A second group of tadpoles were reared in clear chambers which permitted visual cues. Native bluegill (*Lepomis macrochirus*) or South American oscar fish (*Astronotus ocellatus*) were placed in the larger aquarium and freely swam around the chambers f the experiment. Control tadpoles were isolated in both clear and white PVC chambers in aquaria with no fish. The length (mm) and weight (g) of tadpoles were recorded at regular sampling intervals throughout their developmental period. In both the non-visual and visual treatments, the size of tadpoles reared with native and exotic predators did not statistically differ from the control animals. The findings reported here will complement an ongoing, replicate study that focuses on the more palatable tadpoles of the southern leopard frog (*Rana sphenocephala*).

Volkmann, Jessica. Sigma Psi, Florida Institute of Technology. Functional Neuroarchitecture of a Microvertebrate, the Brahminy Blindsnake (*Ramphotyphlops brahminus*).

The retina and brain are both extraordinarily complex structures that drive complex behavior in vertebrate animals, but even the extremely small nervous system of the Brahminy blindsnake drives much the same suite of behaviors as seen in larger reptiles. At only 2mm diameter and 10cm long, the Brahminy blindsnake is among the smallest terrestrial vertebrates on Earth, yet it engages in typical snake behaviors including serpentine and rectilinear locomotion, tongue flicking, and prey acquisition. I have used light microscopy, scanning and transmission electron microscopy, and fluorescence immunohistochemistry (targeting rod- and cone-specific opsins) to define the functional architecture of the *R. brahminus* visual system. The extremely tiny rudimentary eyes of *R. brahminus* are located under skin and scales, and may represent a rare example of evolutionary regression in the face of adaptive progression. Results will be discussed in the context of snake vision and the roles of non-visual photoreception in the control of biological rhythms.

Prohaska, Bianca and Meagan Wise. Sigma Psi, Florida Institute of Technology. Larval flatfish distribution in the Gulf Stream, and transport to juvenile habitats.

The study was conducted to determine seasonal patterns of occurrence of larval flatfish along the edge of the Gulf Stream off Florida. Although flatfish are commercially harvested, their spawning seasons, larval biology, and the role of larval transport in maintaining populations are poorly known. Larval flatfish are primarily pelagic, with a potential for transport by the Gulf Stream, reducing recruitment in southern habitats or increasing recruitment in northern regions. Bimonthly plankton sampling across the edge of the Gulf Stream in 2007 provided data on 13 species of flatfish. For the three main flatfish species, *Bothus ocellatus*, *Citharichtys cornutus*, and *Syacium papillosium*, larvae

were present throughout the year, with peak densities of all three species occurring in the summer months. *B.* ocellatus was the species with the highest overall density throughout the sampling period. Size data provided additional evidence for spawning periodicity of the flatfish species.

Blankenship, Stephanie. Sigma Phi, Guilford College. Genomic variations of rDNA between symbiotic and non-symbiotic nitrogen-fixing, soil microbes.

The relationship between the number of *rrn* operons in a pathogen and its pathogenicity is strongly correlated. The fewer rrn operons a bacterium possesses, the greater the likelihood that antibiotic resistance can occur because of spontaneous rRNA mutations. It has been theorized that bacteria with multiple rrn operons dilute the effect of a spontaneous mutation in one operon. However, low rrn copy number may help lead to a resistant phenotype, or pathogenic species because of amplification of a mutated allele in one to nine operons. The environmental, nitrogen-fixing bacterium, Azotobacter paspali, belongs to a diverse family called Pseudomonadacea. This family also includes genera such as Azorhizophilus, Azotobacter and Azomonas. It has been shown that the species within these genera have between six to eight rrn copy numbers. A. paspali, a plant symbiont, has six rrn operons. Research on pathogenic symbionts would label this species as a potential pathogen based on its rrn number, which is clearly not the case. The focus of this study is to show that environmental species, not just pathogens, can exhibit a low rrn copy number. This study compares four strains of Azotobacter paspali and other members of Pseudomonadacea to show that using rapid pretreatment analysis to determine the rrn genotype may not be relevant in the identification of pathogenic versus non-pathogenic species.

Coppock, Nathaniel. Sigma Phi, Guilford College. A Comparison of Fungal Fruiting Body Abundance and Species Richness in Different Successions of Australian 1B Rainforests.

In Australian Rainforests, Fungi Provide an indispensable role of breaking down organic matter, and returning the nutrients therein back to the plants. In this study, the leaf litter layer of two different successions of a particular type of rainforest were examined closely to observe the different population's fruiting bodies, both in the number present, and the number of distinct fruiting body types. One environment was an established rainforest, while the other was a replanted rainforest of thirty years of age. Physical characteristics of each environment were also tested to determine a correlation. I found a distinct difference in the number of fruiting body types without a clear supporting physical characteristic to account for the difference. While the leaf litter layer mass correlated with both species richness and abundance significantly, and to almost exactly the same degree, they did not correlate within one rainforest type. This shows that one environmental characteristic tested for does not account for differences in fungal communities. This could mean that these differences in diversity could be found from another environmental characteristic, or is due to a combination.

Rodgers, Devin and Constance Rogers-Lowery. Tau Eta, Catawba College. Elevated atmospheric carbon dioxide alters growth and calcification in coral and hydroids.

If atmospheric CO₂ levels continue to rise as projected, the chemistry of the oceans could be altered. Changes in water pH and aragonite saturation could negatively affect growth and calcification in cnidarians. Water pH decrease results in a decrease in aragonite saturation, leading to an observed decrease of growth in coral. A decrease in pH also leads to dissolution of calcium carbonate, potentially leading to decalcification of cnidarians skeletons. The first study subjected polyps of the coral Favia fragum to elevated levels of atmospheric CO₂ and yielded decreased growth rates. The hydroid Hydractinia symbiolongicarpus occurs in colonies much like coral. The calcium carbonate

crystals of H. symbiolongicarpus are made of aragonite, a form of calcium carbonate. These crystals are produced in the endodermal cells of both the adult and planula larva forms. The same conditions of the first study were applied to this hydroid in the larval stage to inquire about the effect of increased CO_2 on the calcification. Due to the resulting decrease in pH, I hypothesize that increased atmospheric CO_2 will decrease the number of calcium carbonate crystals in the organism.

Hamilton, Kaitlin. Beta Alpha, Salem College. Identifying *Drosophila melanogaster* hormone receptors essential for physiology and survival.

Insect pests continue to pose a threat to agriculture. In particular, fruit flies (*Drosophila* spp.) may prove to be a menace to the vineyards of North Carolina. While today's pesticides are one means of controlling this pest, their effects could harm the environment in the process and disrupt the ecology of the region. Instead, a far safer, effective, and specific means of controlling fruit flies may lie in their own genome. This project sought to identify hormone receptors essential for the survival and physiology of fruit flies, and therefore which receptor genes may provide useful for future manipulation to develop new, fruit fly-specific pesticides. Specifically, RNA interference elements were applied to various fruit fly strains and the resulting gene knockdown's effects on survival were studied. Though the results of the experiment were inconclusive, further testing could yield information about the functions and essentiality of various receptors.

Harris, Ryan, Stephanie Songer, Steven Lloyd, and Ryan Shanks. Psi Rho, North Georgia College and State University. The effect of methamphetamine on the spleen in C57Bl/6J mice.

Methamphetamine (METH) is an addictive psychostimulant drug that is abused worldwide. Although METH is a potent indirect agonist of several catecholamines in the nervous system, it also directly and indirectly affects other tissues and organs including the spleen. We observed splenomegaly concomitant with abnormal splenic pigmentation in adult C57BI/6J mice after a 10-day treatment with METH (5mg/kg). Although previous studies have linked spleen pigmentation in young C57BL mice with melanocytes, this phenomenon is absent in adults. In addition, we failed to detect similar pigmentation abnormalities in age-matched control mice. Given the role of the spleen in filtering red blood cells, we hypothesized that the observed METH-induced pigmentation results from macrophage sequestration of excessive blood breakdown products. We employed histochemical techniques to identify the source of this splenic pigmentation and general splenic morphology. We observed hemosiderin deposits in the red pulp of spleens taken from METH-treated mice, which were not present in control animals. We also observed increases in splenic red pulp from METH-treated animals. Furthermore, mRNA analyses of white pulp splenocytes demonstrate significant decreases in inflammatory signaling.

Vaidya, Himani. Beta Alpha, Salem College. Single Nucleotide Polymorphisms in the Interleukin-6 receptor.

Bronchial asthma is an inflammatory disease for which still uncertain. A soluble marker would be useful in assessing the causes of airway inflammation. Since Interleukin 6 (IL-6) is found in increased levels in the bronchoaveolar lavage fluid obtained from asthmatic patients and in their nasal secretions after antigen challenge, IL-6 may be a contributing factor in asthma etiology. TheIL-6 receptor (IL-6R) gene from 96 Caucasians with severe asthma was sequenced and analyzed to screen for rare mutations. No significant rare variant single nucleotide polymorphism appeared in the sample. The polymorphisms found were already known and present in the databases or were found in the non-coding region, which should not affect theIL-6 receptor. Future studies will need to analyze the

mutations already present to see whether they correspond with different levels of IL-6 in patients.

Tuladhar, Shraddha. Beta Alpha, Salem College. Activity of Perylene compounds on Pancreatic Cell lines.

Cancer is one of the leading causes of death in the world and poses an immense threat to the health of an individual. Among different types of cancer, pancreatic cancer cells have a higher tendency to infiltrate and metastasize. Pancreatic Intraepithelial Neoplasia (PanIN) lesions contain K-ras and overexpressed HER-2/neu, which are genetic mutations that are found in human pancreatic cancer. Continuous treatment of these cancer cells with chemotherapeutic drugs results in the development of resistance to these drugs by the mutated cells. A perylene analogue, a G-quadruplex-interactive compound, is used to study its efficacy of perylene compound on the pancreatic cell line BxPC3. Perylene compound facilitates the formation of G-quadruplexes which stabilize the DNA configuration and prevent cancer cells from proliferating. Cells were cultured, treated with the chemotherapeutic perylene compound and cytotoxicity experiments were performed using different concentrations of the drugs. Cells were counted on each plate and the total number of colonies was calculated using a correction factor. At the higher concentrations of 100µM and 200µM, perylene compound was successful in facilitating the G-quadruplex formation, which slowed proliferation of the BxPC3 cells to some extent. Further investigation may show that higher concentrations of perylene compound produce greater limitation of proliferation.

Smith, Amanda, Tommy Jackson, George McMullan, Ryan Orear, and Nancy Eufemia Dalman. Psi Rho, North Georgia College and State University. A Comparison of *Escherichia coli* Levels in the Chattahoochee River between Drought and Non-Drought Years.

The Chattahoochee River, which flows through Helen, Georgia, is a popular summer recreational site. Studies have been conducted in both drought and non-drought years on Escherichia coli levels in the water before and after peak recreational use. Recreational river use may lead to increased levels of bacteria due to sediment disruption and dispersal of bacteria that aggregate in the soil. Water samples were taken at five recreational sites in town and at five pristine non-recreational sites in the Chattahoochee National Forest, on days with highest volume of recreational users, from late June to the middle of September. E. coli were quantified using the Colilert® Quanti - tray® 2000 system (IDEXX), and the results from summer 2009 (a non-drought year) were compared with those from summer 2007 (a drought year). E. coli levels were significantly higher at recreational sites as compared to non-recreational sites for both years. However, no significant difference in E. coli counts existed between morning and evening samples in 2009, but in 2007 E. coli levels were higher during the evening after peak recreational use. Further, evening sampling at recreational sites displayed a correlation between suspended sediments and water - borne E. coli levels in 2007 but not in 2009. This incongruence between years has led us to the conclusion that sediment bacteria, in non-drought years, are more dispersed in the water due to the higher water volume. These results indicate that recreational river users are exposed to higher water – borne E. coli levels during drought years than during non-drought years.

Nolan, Michael W., and Jonathan Walker. Kappa Kappa, Augusta State University. Evidence of metal tolerance in a rare endangered plant species: *Pediomelum piedmontanum* (Fabaceae).

Pediomelum piedmontanum (Dixie Mountain Breadroot) is a rare perennial herb that features only one known serpentine population at Burke's Mt. in Columbia County,

Georgia. This species is currently listed as endangered at the state level by the Department of Natural Resources in Georgia. Reasons for the extreme rarity of this species are still unknown. However, we speculate that the metals present in the substrate may provide insight into its restricted growth habits. In order to determine the extent of metal tolerance, seedlings were transplanted into a hydroponic system enriched with increasing concentrations of nickel sulfate. Nickel was chosen because it is considered a typical characteristic of serpentine soils. Growth of roots and shoots in nickel solution were compared to control solutions without nickel. Results indicate that this species is nickel tolerant. Plants grown in nickel enriched solutions were surprisingly healthier than those in the controls. In addition to monitoring populations, findings from this experiment will help provide insight into the population dynamics of *P. piedmontanum* and hopefully create a heightened awareness of this endangered species.

Wilks, Melissa. Sigma Phi, Guilford College. Ensifer adhaerens: a microbial cave predator.

Ensifer adhaerens are predatory, Gram-negative, nitrogen fixing, rod shaped soil bacteria. They attach non-preferentially to Gram-positive or Gram-negative prey cells and cause lysis. During predation, an external bar-like structure of unknown composition has been reported in electron micrographs of sections stained with uranyl acetate. This structure appears wider at one or both poles and elongates between E. adhaerens and prey cells. For this study, three wild strains of E. adhaerens were isolated from three caves in the United States. The type strain (ATCC 33212) will be used as a control strain. 16S rRNA phylogenetic analysis suggests that the four strains are all very closely-related. Predatory assays using Micrococcus luteus as prey, and the morphological details of the host-prey interaction including this elongated bar structure will be visualized using transmission electron microscopy. In addition, phylogenetic analysis using MultiLocus Sequence Typing (MLST) will be used to define the relationships between different E. adhaerens cave strains and the type strain.

Wood, Stacia, John Workman, Irene Kokkala, Steven Lloyd, and Ryan Shanks. Psi Rho, North Georgia College and State University. The effects of methamphetamine on the reproductive system of male C57BI/6J mice.

In 2005, the National Drug Intelligence Center reported methamphetamine (METH) abuse to be higher than heroin, with specific detrimental trends targeting the adult male population. We have observed changes in gonad morphology as well as behavioral changes in male mice treated with METH over 10 days, which could be driven by neuroendocrine dysregulation. Oxidative damage in the brain, caused by METH-induced dopamine dumping, effects neuroendocrine functioning. For example, alterations in gonadotropin release from the pituitary regulate testosterone production in the testes. Testosterone is known to affect behavior as well as the structure and function of the testes. Therefore, we predicted that METH exposure would increase gonadotrophin release from the anterior pituitary leading to increases in testosterone. C57BI/6J mice were injected with METH (5mg/kg) or saline for 10 days. The reproductive tracts from both treatment groups were collected for histological analysis. Testes were collect for mRNA expression analysis and serum was collected for steroid hormone analysis. We identified METH-induced increases in the level of serum testosterone using an immunoassay. PCR analysis of mRNA expression in the testes further supports an increase in steroidogenesis as well as spermatogenesis after METH treatment. Histological analyses of the reproductive tract will provide further information about possible cellular alterations underlying these changes.

Oltean, Corina, Hillary Doyle, Steve Jett, Kayla Fann, Brenna Finlayson, Heather Iverster, Chuck Robertson, Steven Lloyd, and Ryan Shanks. Psi Rho. North Georgia College and State University. The effects of prenatal methamphetamine exposure on executive functions in adult C57Bl/6J mice.

Methamphetamine (METH) is a commonly abused psychostimulant with unknown teratogenic potential. As a result of its addictive properties, METH abuse may continue during pregnancy, resulting in neonatal exposure. We predict that prenatal METH will alter frontal brain development resulting in deficits in executive functions in adulthood. To model prenatal exposure, C57BL/6J mice have been injected with saline or METH (5mg/kg) from embryonic day 8.5 until birth. Executive functions (such as working memory, attention and impulsivity) are currently being measured using a five-choice serial reaction time task (5CSRTT) operant paradigm in adulthood (3-4months of age). This paradigm uses a 5-hole operant chamber and an established training protocol based on positive reinforcement and positive punishment. The animal is tasked with performing a specific, discriminative response to a visual stimulus presented at various intervals and locations. In addition to quantitative measures of impulsive responses (e.g., premature responses), we are measuring task acquisition based on trails to criteria (correct responses and omissions) between in utero saline and METH-treated animals.

Bower, Luke. Sigma Gamma, Erskine College. Preliminary Assessment of Striped Mullet (*Mugil cephalus*) pectoral fin Tissue Damage Caused by the Parasitic Isopod *Nerocila acuminate* (family Cymothiodae).

The parasitic isopod, *Nerocila acuninata*, is known to attach to the skin of a variety of marine fish species, often times causing the death of those fish. In this study we examined the tissue damage on the pectoral fin of Striped Mullet (*Mugil cephalus*), caused by the parasitic isopod *Nerocila acuninata*, through histological processes. Two infected pectoral fins were examined and compared to an uninfected fin. Upon superficial inspection, a large, white mass of tissue was observed on the pectoral fin where the anterior of the isopod had been attached. Extensive hemorrhaging was evident at the base of the fin, just past the head of the isopod. The comparison of histological sections of infected and unaffected tissue showed a significant amount of inflammation and fibrous tissue build up in the infected tissue. Abnormally high levels of lymphocytes and erythrocytes were observed in the tissue of the host's fins. There were a reduced number of melanophores in the infected tissues compared to the unaffected fin, causing a loss of pigment in infected fin. These findings indicate that the isopod may cause serious, irreparable harm to the host leading to a decrease in overall fitness or death.

Powell, Elizabeth, Xochitl Arzeta-Ferrer, Veronica Obregon, Samantha Renaud, Richard Keen, and Neval Erturk. Nu Xi, Converse College. Identifying the Role of Adenosine Receptor Subtypes in Temporal Perception.

We undertook two studies that were designed to identify the role of adenosine receptors on temporal perception. Literature shows that Dopamine has a role, but our previous studies have shown that non-selective adenosine antagonists can affect temporal perception (e.g., caffeine). However, few studies have been conducted to identify which specific receptor sub-type is responsible for these changes. The roles of the four adenosine receptor sub-types (i.e. A_1 , A_{2A} , A_{2B} , and A_3) on temporal perception were compared by using Intraperitoneal (IP) injections of selective, reversible adenosine antagonists. Rats were trained using a Stubb's timing procedure for both studies. The first experiment showed little difference between the A_1 , A_{2B} , and A_3 receptor subtypes and the sham control. However, significant difference was shown between the sham control and A_{2A} antagonist group. A_{2A} antagonist caused an increase in temporal perception. A second experiment was conducted in order to further investigate the role of the A_{2A} antagonist on

temporal perception by comparing three concentrations of A_{2A} antagonist (50, 75, and 100% of A_{2A} dose in Experiment 1) were compared with a sham control. Results show a dose dependent relationship between the A_{2A} antagonist concentration and changes in temporal perception. Our two studies show that A_{2A} receptors play a clear role in temporal perception. Future use of this research could be in the study of adenosine agonists within the pharmaceutical field and determining whether the A_1 , A_{2B} , and A_3 receptor subtypes could also have a dose-dependent antagonist effect with a decrease in temporal perception.

Alber, Keli, Katherine Buehler and Edna Steele. Nu Xi, Converse College. Are Carrots and Pumpkin Seeds Effective Homeopathic Remedies for Hymenolepis diminuta Infections? Sixteen male Wistar rats were experimentally infected with Hymenolepis diminuta cysticercoids. After infection was confirmed, they were separated randomly into four equal groups. One group received oral treatments of 2.0 mL carrot juice (16 g/mL). Another group received 2.0 mL pumpkin seed juice (1 g/mL) and the negative control group received 2.0 mL distilled water. The positive control group received a one-time oral treatment of praziquantel (0.5 mg/kg BW) on the first day, and then distilled water only for the remainder of the treatment period. The treatments were administered to each rat daily for a total of 15 days. Tapeworm eggs were collected from rat feces using modified zinc sulfate floatation. Examination of fecal samples revealed presence of numerous eggs throughout the treatment period in feces of all rats in both the experimental (carrot- and pumpkin seed-treated) and negative control groups. The presence of adult tapeworms in these rats was further confirmed upon dissection of intestines of euthanized animals. All rats that received one dose of praziguantel (positive control) were completely free of tapeworms by day 14 post treatment. Results of this study indicate that carrots and pumpkin seeds were ineffective anthelminthics against *H. diminuta* infections.

*District I Johnson Award Winner, Best Poster

Poster Presentations Southeastern District II

Vaughn, Bethany and William C. Wetzel. Rho Theta, Thomas More College. Analysis of Hair by Inductively Coupled Plasma-Atomic Emission Spectrometry.

Quantifying trace metals in the human body is useful for determining if levels of specific nutrients are lacking, normal, or elevated. Although a variety of bodily fluids or tissues could provide information about trace metal levels, human hair is often employed because of the relative ease of sample collection and preparation. Trace element profiles of hair can also indicate if an individual has been exposed to toxic pollutants by means of either inhalation or diet. Tobacco is an agricultural product that pyrolyzes into many compounds which are subsequently inhaled, absorbed by the body, and secreted in hair as it grows. Consequently, any trace metals ingested via tobacco smoke are recorded in the hair itself. By examining the scalp hair of smokers, non-smokers, and persons exposed to secondhand smoke, differences may be seen in the trace metal levels found. In this study, hair from individuals exposed to various levels of tobacco smoke will be tested for several trace metals by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES). Various digestion methods have also been evaluated for their suitability for hair analysis. Additionally, trends in the trace metal concentrations in hair samples will be correlated with age and degree of tobacco exposure.

Williams, Kimberly N., Mark Bolt, and Joseph C. Whittaker. Pi Zeta, Pikeville College. Isolation of mitochondrial DNA and polymerase chain reaction to differentiate between *Peromyscus leucopus* and *P. maniculatus* using species-specific primers.

The white-footed mouse (*Peromyscus leucopus*) and deer mouse (*P. maniculatus*) are often abundant and occupy the same habitats. Additionally, these two species are difficult to differentiate from one another in the field. This project built upon previous projects which used cellulose acetate electrophoresis of allozymes of salivary amylase. By comparing allozyme analysis with morphological measurements we have found measurements to be an unreliable method. Of all the samples, if only morphological measurements are used, 33% of the samples would be indistinguishable between *P. maniculatus* and *P. leucopus* because of measurement overlap. An additional 15% would have been incorrectly identified. This project continued using cellulose acetate electrophoresis but also attempted to look directly at the mitochondrial DNA of the two species. We attempted to isolate DNA from cheek cells in saliva samples and toe clips from frozen mouse specimens. Initial attempts to isolate cheek cells from saliva samples proved to be ineffective, but we were able to successfully isolate DNA from toe clips.

Diaz, Veronica. Mu Chi, Midway College. The Effects of Various Alcohols on the Common House Plants, *Araceae*.

Philodendron is a member of the plant family, Araceae, a house plant commonly used in commercial settings. The purpose of this study was to discover whether watering with alcohol could limit Philodendron's growth to minimize pruning expense. The experiment was conducted in quadruplicate. The experimental plants were hydrated with serial dilutions in deionized water of either Beefeater gin or Absolute vodka. Control plants received filtered deionized water. Each plant received routine daily care. Weekly measurements of height, width, bud and leaf counts were recorded. Level of significance for all statistical tests was set at p<0.05. D'Agnostino and Pearson test for normality was passed; therefore, parametric tests were warranted. Quantitative comparisons between treatment groups and the effect of treatment by week were analyzed by 2-way ANOVA. No significant effect of treatment was identified even thought the 2-way ANOVA was significant at p<0.0001. Analysis of change over time as compared to controls in plant width and number of leaves was significant, but change in height was not. Study over a longer time period is needed to determine if the alcohols would have a significant treatment effect on plant height.

Meissner, Khristina. Mu Chi. Midway College. Identification of the source of fecal contamination in waters of the lower Kentucky River basin: detecting *Bacteroides* markers through PCR analysis.

Fecal contamination in water causes disease and environmental problems. The source of contaminants must be evaluated to manage fecal pollution. Current research is focused on Bacteroides as a source indicator for fecal pollution. The objective of this study was to evaluate the source of fecal contaminates in waters of the lower Kentucky River basin by using PCR to detect human specific HF183 and cow specific CF128 Bacteroides markers. Portions of four streams were evaluated to determine sources of fecal contamination in the lower Kentucky River Basin. Multiplex PCR was performed with human and cow specific primers for Bacteroides markers. Data was collected based on whether the samples tested positive or negative for the target indicator during gel electrophoresis. The results were grouped into the percentage testing positive/ negative for human and/ or ruminant source groups. The PCR primers were specific and detected the presence of human and cow Bacteroides markers. Bands were detected for cow and human markers at ~250 bp and ~150 bp respectively. The results indicated fecal contamination was present in rivers and streams of the lower Kentucky River Basin. Fecal contamination from cows was greater in rural areas, and human fecal contamination was greater in urban areas.

Silvers, Jennifer K. Mu Omicron, Columbus State University. Effect of natural antiinflammatory agents on toll-like receptor 2 expression: Implications for Lyme Neuroborreliosis Response.

Lyme Neuroborreliosis (LNB) is a chronic infectious disease of the central nervous system (CNS) caused by a tick-borne spirochete, Borrelia burgdorferi. Astrocytes express Toll-like receptors (TLR) which play a major role in immune responses against microbial pathogens. There are known herbal supplements including garlic, bromelain and grape seed extract which have anti-inflammatory properties which may be able suppress LNB induced inflammation. The purpose of this study was to test the effects of natural antiinflammatory agents on the expression of TLR2 in astrocytes. The mouse cerebellumderived astrocytes were treated in 12-well plates for 24 hours with either garlic (100 mg/L), bromelain (1 mg/ml), grape seed extract (0.5 mg/mL) or control. Astrocytes were pretreated with cefotaxime (1.5 mg/ml), the current conventional, pharmaceutical treatment for LNB. Lipidated outer surface protein A (L-OspA, 0.25 µg/ml) was used to induce inflammation. Preliminary studies indicate bromelain was toxic to the astrocytes. Following protein isolation, the TLR2 protein levels will be measured using primary mouse anti-human TLR2 antibody and the Invitrogen WesternDot system. The protein bands will be visualized using GelDoc software. A total of three trials will be run, and the band densities will be analyzed using 2-way ANOVA and Tukey's post hoc test.

Biebinger, Barbara L. and Lisa Ann Blankinship. Mu Epsilon, Troy University. Survey of Antibiotic Sensitivity in Cell Phone Isolate Organisms.

Antibiotic resistance is a rapidly growing and widespread problem in the healthcare setting; however, we must turn our attention to the growing incidence of "community acquired" infections where antibiotic resistant bacteria are currently beginning to flourish. The "superbugs" that were once thought to only be acquired in hospital settings are now being found in every location from schools, offices, farms, and individual homes. In this study, samples were collected from the cell phones of faculty, staff, and students at Troy University in Troy, Alabama. Individual species were isolated and identified by biochemical tests using dichotomous keys. Twenty isolates representing eight cell phones were tested for antibiotic susceptibility using the Kirby-Bauer Method. The cell phones tested in this contained Staphylococcus aureus, Corynebacterium pseudodiptheriticum, Enterococcus faecalis, Proteus mirabilis, Bacillis megaterium, and Alcaligenes paradoxus. Of these bacteria, most were susceptible to current broad-spectrum antibiotics; however, some species showed resistance to older antibiotics.

Rihm, Laura and Bethany Bowling. Mu lota, Northern Kentucky University. Assessing Undergraduate Genetic Literacy and the Impact of Instruction.

There has been little exploration or evaluation of genetics knowledge and education for undergraduates, especially non-science majors. In response to the need for the evaluation of undergraduate genetics education, a Genetic Literacy Assessment Instrument (GLAI) was developed and evaluated and found to be an overall valid and reliable assessment tool. The instrument is based on the central concepts in genetics that an undergraduate non-science major should understand as outlined by a subcommittee of the American Society of Human Genetics. While the GLAI has been found useful in examining introductory level genetics understanding, several questions were identified as needing improvement. Over the past year, six questions have been revised and piloted. Our research consisted of two components, one which considered the impact of instruction on the genetics knowledge of non-science majors in five introductory biology and genetics courses using the GLAI V2 and a second that analyzed qualitative data on students' preconceptions regarding the relationships among the terms 'gene', 'chromosome', and 'genetic code'. This type of free response allows for an insight into the knowledge and

misconceptions students have when entering these introductory biology and genetics courses.

Elswick, Maranda, Jane E. Argentina, and Joseph C. Whittaker. Pi Zeta, Pikeville College. Impacts of surface mining and coal extraction on Asian clam (*Corbicula fluminea*) growth and mortality in tributary streams in southwestern Virginia and eastern Kentucky.

Coal mining, especially surface mining, threatens both terrestrial and aquatic habitats. Appalachia contains a high diversity of fish and aquatic invertebrates that are being threatened, including freshwater mussels which have steadily declined in Virginia waters. To assess whether or not these mussels can be reintroduced, Asiatic clams (*Corbicula fluminea*) were placed in 10 tributaries of the Levisa Fork of the Big Sandy River, each differing in mining disturbance. After 60 days rates of clam growth and mortality were calculated as indicators of the health of the tributaries. Water quality tests were taken every two weeks to further gauge stream health. Although clams grew at each site, growth rates were lower and mortality higher at streams with more mining disturbance. However, because of the overall success of the Asiatic clams, native freshwater mussels may be able to be reintroduced into the Levisa Fork.

Damron, Marie, Robert W. Arts, and Joseph C. Whittaker. Pi Zeta, Pikeville College. Responses of salamanders to simulated environmental vibration.

The Appalachian region is renowned for its coal. The vibrations and sounds produced by vehicles such as coal trucks may induce behavioral changes in salamanders. Few studies have shown that salamanders do respond to environmental disturbances. These responses may be behavioral or physiological. Species examined included Desmognathus ochraphaeus (mountain dusky), Desmognathus fuscus (northern dusky), Plethodon glutinosus (slimy salamander), Plethodon richmondi (ravine salamander), and Notophthalmus viridescens (eastern newt). Thirty-one subjects were used. Salamanders were exposed to simulations of vibrations consistent with those generated by passing coal trucks. Data for the vibration simulations were collected from a moving coal truck using three low-g accelerometers. Data used for the sound simulation came from video footage of the moving coal truck. Subjects were observed before, during, and after the trials. Before and after each trial, each subject was wiped clean of debris and weighed. The amount of secretions varied between species. Overall, there were 77 standard simulation trials and 29 distance variation trials (i.e. observing behavior at different distances from vibration source). Each trial was recorded using a digital video recorder. Overall, nine categories of behaviors were observed and recorded. The relationship between species, behavior, and skin secretions will be further discussed.

Burden, Nakita. Mu Omicron, Columbus State University. Identifying Complex Taxonomic Groups of Native and Cultivated Rhododendrons Using DNA Barcoding.

Taxonomically Complex Groups of flowering plants such as Rhododendrons contain numerous species including eight subgenera and over 2000 individual species. Therefore, identifying them using DNA barcodes is of interest, especially in native and cultivated plants that are grown together with similar morphology. DNA barcoding is a method used to monitor biodiversity or identify individuals using short genetic markers in the mitochondrial genome. Barcoding is most successful in animals using the CO1 gene region of the mitochondrial genome because mitochondrial evolutionary rates are faster than those of plants. For plant species, I used *rbcL* and *matK* gene regions of the plastid genome because they proved to distinguish among various plant species (Fazekas et al 2008). The diversity and complexity of these plants will test the effectiveness of my barcodes. I collected 50 plant specimens of native and cultivated Rhododendrons, extracted DNA and performed PCR on each sample. Next, I used the Geneious program

to align sequences and produced a cladogram showing taxonomic relationships among species. I expected greater diversity among subgenera or distinctiveness between elepidotes and lepidotes or between deciduous and evergreen species.

* Reis, Adam and William C. Wetzel. Rho Theta, Thomas More College. Utilization of Zebra Mussels (*Dreissena polymorpha*) as Biomonitors of Water Quality.

Zebra mussels are effective biomonitors of water quality because they are filter feeding organisms capable of accumulating metals from the water into their tissues. An analysis of the soft tissue provides information about the levels of trace metals in the water. Thus, these organisms have been used to indicate the quality of various bodies of water. Environmental conditions in aquatic ecosystems vary continually due to the input of pollutants on a daily basis. However, the accumulated metals in the soft tissue of zebra mussels provide an indication of the average amount of pollution in a body of water over a longer period of time. In this study, Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) was used to identify the amount of trace metals contained within the tissues of zebra mussels from the Ohio River. Trace metal profiles along the Ohio River were created, and future work will be directed towards understanding the effects of these trace metals on zebra mussels using cobalt as a test metal. Cobalt uptake rates, saturation levels, and toxicity levels will be investigated. This paper will discuss the sample preparation methods, preliminary results, and future work.

Warne, Jennifer N. Mu Iota, Northern Kentucky University. Microbial growth on soft contact lenses.

Infectious corneal ulcers caused by bacteria are common among contact lens users. This is one of the many reasons that optometrists recommend practicing good contact lens care. This study is designed to isolate some of the bacteria and fungi present in contact lenses that have been disinfected and/or stored in saline solution for different lengths of time. Biofilm buildup in soft contact lenses worn by patients was also examined and correlated with the care the patients have practiced. Bacteria and fungi were cultivated in different media, and the results show substantial bacterial and fungal growth even after following prescribed care of the lenses. The longer the lenses were stored, the more growth was observed. These results will help provide a better understanding of the cause of ocular infections.

Kirkland, Lindsay. Mu Phi, Jacksonville State University. The Toxicity of the Aquatic Selective Herbicide, Fluridone to *Gambusia affinis*.

Fluridone is an aquatic herbicide that is used in waterways throughout Alabama. This experiment was conducted using the fish species *Gambusia affinis* to show whether fluridone has any toxic effects. This experiment's results are evidence for whether increased salt has any impact on fluridone. This experiment's hypothesis is that Fluridone has a greater toxicity on estuarine as opposed to freshwater to *Gambusia affinis*. Mosquitofish collected from a nearby spring were then regularly feed and acclimated to laboratory conditions. They were then divided into a freshwater group and a saltwater group, in which the salinity was acclimated to 10ppt. One control group and four treatment groups were devised for salt and freshwater. 400mL beakers were used to fill 200mL of treatment to all experimental groups. Fluridone concentrations ranging from 0.01 to 50mg/L were added to all treatment groups. The control and treatment groups were then incubated at room temperature for four days. Observations and mortality counts were taken daily. Mortalities occurred at 50 mg/L of fluridone within the first twenty-four hours for fresh and saltwater groups. This indicates that high concentrations of Fluridone are detrimental to mosquitofish.

Daniels, Miranda and Christi Magrath. Mu Epsilon, Troy University. Transcription termination in replication impaired strains of *S. cerevisiae*.

Two important molecular processes are transcription termination signals and replication signals. In Saccharomyces cerevisiae, Autonomously Replicating Sequences (ARSs) are the origin and primary regulatory element in DNA synthesis and transcription termination sequences provide the some of the signals that trigger the halting of transcriptional elongation and the dissociation of the transcription machinery. In previous research, a transcription termination reporter construct was used to evaluate termination transcription in replication deficient strains. Difficulties in assessing the levels of transcription termination in one of the strains occurred. In this experiment, the replication mutant strains ΔMCM10-1, ΔMCM1-1, ΔMCM3-10, and a wild type strain will have a transcription termination reporter construct introduced to assess termination of transcription when replication is diminished (turned "off"). All the mutant strains and the wild type strain W303 were revived from stock cultures and, after evaluating different culturing techniques, working stock cultures of Δ MCM3-10 were established and maintained. transformation of the transcription termination reporter was attempted, but was not successful; control transformations were also not successful. Continuing the effort to evaluate the transcription termination level of this mutant strain should assist in establishing the relationship between replication and transcription termination.

Neel, Sara. Mu Iota, Northern Kentucky University. Periphyton from the Licking River Watershed: Common species and their ecological significance.

The Licking River watershed drains a 3600 square mile area of mostly agricultural land. It eventually ends in the Ohio River and may contribute to the nutrient enrichment that causes the dead zone in the Gulf of Mexico. Licking River Watershed Watch volunteers sampled algae and collected water quality information at several sites along the River in October 2009. We present here the results of the algae samples and their relation to other water quality parameters. Algae that thrive under nutrient enrichment dominated the samples from all sites. High coliform levels indicate that sewage is the most likely cause of this nutrient enrichment.

*District II Johnson Award Winner, Best Poster

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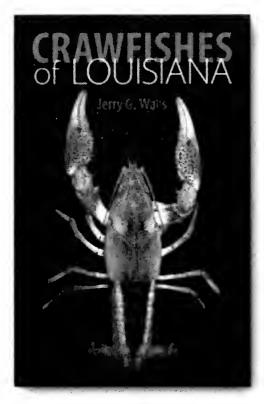
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More information about SAFC may be obtained from their web site at http://www.safc.org, and by e-mail at safc@safc.org. The mailing address is Southern Appalachian Forest Coalition, 46 Haywood Street, Suite 323, Asheville, North Carolina 28801-2838. The telephone number is (828) 252-9223.

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OBITUARIES

Jack S. Brown, Sr.

1929-2010

Dr. Jack. S. Brown, Sr., of Florence, Professor Emeritus, University of North Alabama, passed away at his home on March 20, 2010. He was 81.

A memorial service will be held at the First United Methodist Church, Florence, on Saturday, March 27, 2010 at 3:00 p.m. The Rev. Gary Formby will officiate. The family will be in the atrium after the service. Dr. Brown will be buried in the family cemetery in Ryland, Alabama.

Dr. Brown was born in New Orleans, Louisiana and grew up in Maysville, Alabama graduating from Madison County High School. He received his undergraduate degree in Biology from Tulane



University in New Orleans in 1948 at the age of 19. A year later, he began his teaching career as a biology professor at Jacksonville State University, Jacksonville, Alabama. In 1952, he enrolled at the University of Alabama to begin work on his doctorate. Auburn University called him to teach in 1954 and from 1955-1958 he was called to service in the U.S. Air Force stationed at Gunter Air Force Base in Montgomery, Alabama in the School of Aviation Medicine. Upon completion of his PhD in 1956, and his term of duty in 1959, Dr. Brown was named Chairman of the Biology Department of Emory & Henry College in Emory, Virginia. In 1963, he was named Dean and Professor at Parsons College in Fairfield, Iowa. Dr. Brown returned to Alabama in 1968 to teach at Florence State University, now University of North Alabama. During his 23 years at UNA, he served as the Biology Department Chair, Director and founder of the Fresh Water Institute, a member of the Faculty Senate, a charter faculty member of Phi Kappa Phi Honor Society, and on numerous academic committees. He was a member of the Association of Southeastern Biologists.

After retiring from UNA, he and his wife established the library at Shoals Christian School where on their 50th wedding anniversary, the school dedicated the library in their name. Dr. Brown was a Past President of the Florence Lions Club and was an active Board Member of the UNA Sportsman Club. He was a tireless promoter of the American Heart Association and CPR education. He was a physical fitness enthusiast holding instructor designations in scuba diving and Nautilus exercise equipment.

Dr. Brown leaves behind his wife of 61 years, Myrtle; a sister, Georgia Moncada and husband, Joe, Pittsburg, PA; a daughter, Patricia Bratcher, and husband, Brad, Athens, AL; a son ,Stan , Hueytown, AL; granddaughters Angela Sonego, Nashville, TN, Allison Brown, Houston, TX, and Jessica Brown, Beaumont, TX; and grandsons, Chris Sonego and Scott Bratcher, Athens, AL.

The family would like to thank Dr. Patrick Daugherty and the staff of Hospice of Tennessee Valley for their care and support.

In lieu of flowers, donations can be made to Shoals Christian School, First United Methodist Church, and Woodmont Baptist Church.

Elkins Funeral Home is assisting the family. You are invited to sign the online guest register at www.elkinsfh.com.

Dr. Terry R. Richardson, Department of Biology, University of North Alabama, Florence, AL 35632.

William Haynes Ellis

1931-2010

Dr. William Haynes Ellis, 78, Winchester, formerly of Clarksville, died Sunday, March 21, 2010, at St. Thomas Hospital.

The funeral will be held at 11:00 a.m. Thursday at Sykes Funeral Home Chapel with Dr. Felts Dent officiating. Burial will be in Greenwood Cemetery. Visitation will be from 4:00 to 8:00 p.m. today at the funeral home. Sykes Funeral Home & Crematory is in charge of arrangements.

Dr. Ellis was born December 4, 1931 in Cedar Hill, TN, son of the late William Bryan Ellis and Hattie Marie Haynes. He was preceded in death by his brother B. Wayne Ellis.

Dr. Ellis was Professor of Biology at APSU, Director, Graudate Studies, Director, Institutional Research, Dean of Faculty, Dean of Graduate and Professional Programs, and Vice President, Academic Affairs. His higher education degrees were a Bachelor of Science Degree (B.S.), and Master of Arts in Education Degree (M.A.) from APSU, and Doctor of Philosophy Degree (Ph.D.) from the University of Tennessee. He was elected to Dean Emeritus status at APSU, and also elected to Professor Emeritus status at APSU. He had multiple memberships in professional and state organizations including the Tennessee Academy of Science and the Association of Southeastern Biologists, a member of Rotary International, Member, Clarksville Rotary Club, President, Clarksville Rotary Club, Governor, Rotary District 6760, Charter Member, Clarksville (Sunrise) Rotary Club, Member Winchester, TN Rotary Club, Paul Harris Fellow, Clarksville Rotary Club. He served in the US Army during the Korean War. He received an Honorable Discharge after serving from June 1953 to March 1955.

He is survived by his wife Agnes B. Ellis, a daughter Dr. Elizabeth (Daniel) Ellis Reimers, and two grandchildren Emily Elizabeth Reimers and Olivia Grace Reimers. Other survivors include Sue Perry Ellis Long; nephews: Perry Ellis, Ben Ellis and niece Page Ellis Mayo.

Pallbearers will be Phillip Chambers, Brandon Chambers, Robert Eley, Ron Reimers, Dr. Ben Stone. Dr. Floyd Scott, Dr. Eugene Wofford and Lloyd Scott. Honorary pallbearers will be Rotarians.

Memorial contributions may be made to the American Diabetes Association, the American Heart Association, or Dr. William H. Ellis Scholarship Fund at APSU. www.sykesfuneralhome.com.

Published in The Leaf Chronicle, Clarksville, Tennessee, on March 24, 2010.

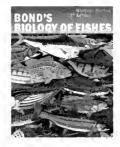


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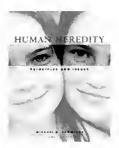
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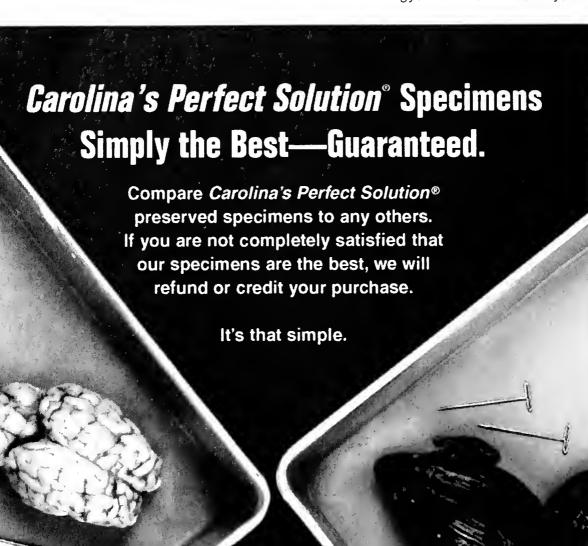


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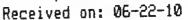
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